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**VALUE CHAINS FOR NUTRITION:
THE APPLICABILITY OF VALUE CHAIN APPROACHES
TO ADDRESS LOW FRUIT AND VEGETABLE CONSUMPTION IN FIJI**

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Thesis submitted in accordance with the requirements for the degree of
Doctor of Philosophy of the University of London

August 2014

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Faculty of Public Health and Policy
London School of Hygiene and Tropical Medicine

Funded by the Leverhulme Centre for Integrative Research on Agriculture and Health

STATEMENT OF OWN WORK

I, Emily Morgan, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed: Date:

ABSTRACT

Nutrition-oriented value chain analysis has been proposed to support the identification of solutions to nutrition problems, such as low fruit and vegetable (FV) intake. Through a case study of Fiji's FV sector, this thesis explores the application of the approach and aims to identify its strengths, limitations, and potential to inform public health action to increase FV intake.

Following a review of models of value chain analysis, the strategic business management model was adapted and methods were selected to collect relevant data. Focus groups with urban consumers were used to establish what they value in FV. Following this, workshops, semi-structured interviews, and observations with chain actors and stakeholders were used to map three exemplar chains (amaranthus, papaya, and tomatoes) and investigate their performance in respect to delivery of consumer-defined value. Data were analysed thematically.

Urban Fijians identified both price and quality as important to food choice and considered quality in terms of taste and appearance, perceived health properties, freshness, and convenience. Consumers described inconsistent availability and high prices as barriers to consumption.

The exemplar chains were relatively basic, with most activities performed by farmers. Access to agricultural inputs was a challenge, as was limited transportation and market infrastructure. Actors tended to view consumers as driven by price and therefore focused on cost-minimisation rather than value addition. Most farmers received little information on supply and demand trends; however, strong relationships appeared to enhance product and information flows. Across the chains, high vulnerability to natural disasters impaired the delivery of consumer-defined value.

The findings identify opportunities to enhance FV availability, affordability, and acceptability by promoting the qualities of FV that consumers value, reducing bottlenecks in the chains, and

strengthening relationships between actors. They also suggest a benefit of the strategic business management model of value chain analysis for guiding research for nutrition.

ACKNOWLEDGEMENTS

First, I would like to thank my supervisors, Dr. Karen Lock and Dr. Alan Dangour, for their expertise, guidance, and encouragement at all stages of the PhD. I am particularly indebted to Karen for encouraging me to take on this topic and for her constant support and patience.

I would like to thank all of the people who participated in this study for sharing their valuable time and experiences. I am grateful to my collaborators and colleagues in Fiji, with whom it was a pleasure to work. This research could not have happened without the support of the National Food and Nutrition Centre, the Pacific Research Centre for the Prevention of Obesity and Non-communicable Diseases, and the Department of Agriculture. In particular, Penina Vatucaawaqa and Dr. Wendy Snowdon were instrumental in helping me set up the fieldwork and offered invaluable guidance throughout, and Ateca Kama, Miliakere Nawaikula, and Tepola Seniloli provided much appreciated support and input. I am grateful also to Arleen Sukhu and Asaeli Naika for their assistance and enthusiasm with data collection and to Susana Lolohea for helping me navigate local immigration processes.

I am very appreciative of the Leverhulme Centre for Integrative Research in Agriculture and Health (LCIRAH) for funding this research and to my LCIRAH colleagues for enriching my thinking on interdisciplinary research and the links between agriculture, food systems, nutrition, and health. I also would like to thank Professor Tony Worsley and Dr. Corinna Hawkes for their advice and Professor Ben Bennett, Dr. Nigel Poole, Dr. Elaine Ferguson, Professor Bhavani Shankar, and Dr. Zaid Chalabi for their input into the development of the work.

Finally, this research would not have been possible without the help and motivation of my family and friends. A special thanks to my parents for their inexhaustible encouragement, Fahad for continual optimism, and my amazing sister, Natalie, for friendship, perspective, and endless support.

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ABBREVIATIONS AND ACRONYMS

AAACP	All ACP Agricultural Commodities Programme
ADB	Asian Development Bank
AICR	American Institute for Cancer Research
ALTA	Agricultural and Landlord Tenants Act
CGIAR	Consultative Group on International Agricultural Research
C-POND	Pacific Research Centre for the Prevention of Obesity and Non-communicable Diseases
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
ECR	Efficient Consumer Response
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FBS	Food Balance Sheet
FFQ	Food Frequency Questionnaire
FIBoS	Fiji Islands Bureau of Statistics
FJ\$	Fijian Dollar, FJ\$1 is approximately £0.32
FPAN	Fiji Plan of Action for Nutrition
FV	Fruit and Vegetable
GCC	Global Commodity Chains
GDP	Gross Domestic Product
GPN	Global Production Network
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit now Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ, German Society for International Cooperation)

GVC	Global Value Chain
IARC	International Agency for Research on Cancer
ICP	International Comparison Project
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
IPCC	International Panel on Climate Change
LSHTM	London School of Hygiene and Tropical Medicine
NCD	Non-Communicable Disease
NFNC	National Food and Nutrition Centre
NLTB	Native Land Trust Board
NNS	National Nutrition Survey
NPK	Fertiliser containing Nitrogen, Phosphorus, and Potassium
NT	Network Theory
PAST	Problem and Solution Tree
PAT	Principal-Agent Theory
RA	Research Assistant
RBV	Resource-Based View
SCM	Supply Chain Management
STEPS	WHO STEPwise approach to Surveillance of NCD Risk Factors
TCE	Transaction Cost Economics
TFQM	Total Food Quality Model
UK	United Kingdom
UNCCD	United Nations Convention to Combat Desertification
UNIDO	United Nations Industrial Development Organization
UN-OHRLLS	United Nations Office of the High Representative for the Least

	Developed Countries, Landlocked Developing Countries, and Small Island Developing States
USAID	United States Agency for International Development
VCM	Value Chain Management
WCRF	World Cancer Research Fund
WFP	World Food Programme
WHO	World Health Organization
YWCA	Young Women's Christian Association

CHAPTER ONE: INTRODUCTION

1.1 Background

Poor diet is a primary driver of disease burden and a serious global public health problem (Lim et al., 2012). Major nutrition challenges include undernutrition, micronutrient deficiencies, and overweight/obesity. An estimated 840 million people suffer from hunger and food insecurity (FAO, 2013) and over two billion are undernourished in micronutrients (Micronutrient Initiative, 2009). At the same time, excess energy intake is an important risk factor for the global epidemic of obesity and nutrition-related chronic disease. Chronic diseases, including cardiovascular disease, cancer, and diabetes, are responsible for 60% of global deaths per year (WHO, 2005b).

The agriculture and food system (often referred to as the agri-food system) has important consequences for diet, nutrition, and health, and there is strong consensus that it can make a greater positive contribution by improving the availability, affordability, and acceptability of healthy foods (Dangour et al., 2012; Fan & Pandya-Lorch, 2012; Hawkes & Ruel, 2006).

However, there is a need for evidence on how agri-food systems could be leveraged most effectively for nutrition and health (Berti, Krusevec, & FitzGerald, 2003; Dangour et al., 2013; Masset, Haddad, Cornelius, & Isaza-Castro, 2012; Ruel, Alderman, & Maternal and Child Nutrition Study Group, 2013). Methods, such as nutrition-oriented value chains analysis, are emerging to assess agri-food systems from a nutrition perspective and identify possible opportunities for intervention, but have not yet been applied extensively (Hawkes et al., 2014).

This thesis documents a research study undertaken to assess the utility of nutrition-oriented value chain analysis to identify how fruit and vegetable (FV) value chains contribute to availability, affordability, and acceptability and possible opportunities for intervention. Case study research was undertaken in the Republic of Fiji (henceforth referred to as 'Fiji') and utilised a combination of qualitative methods to explore what urban consumers value in FV and how the various activities and decisions involved in FV value chains influence the delivery of that value. The

background to the problem of low FV consumption in Fiji and the research approach are discussed, as are the potential strengths, limitations, and future applications of the approach.

In this chapter, global dietary change is introduced and the nutrition transition framework is presented (Section 1.2). Following this, the role of FV in the diet, determinants of FV intake, and interventions to increase FV intake are discussed (Sections 1.3-1.5). Next, linkages between agriculture, food systems, nutrition, and health are introduced briefly (Section 1.6). In the final two sections (Sections 1.7 and 1.8), the aims and objectives of the PhD research are specified and an outline of the thesis is provided.

1.2 Nutrition transition and the global burden of diet-related disease

Major shifts in diet and physical activity patterns with corresponding consequences for nutrition and health have occurred throughout human history. The ‘nutrition transition’ framework describes such shifts, which are thought to be driven by major demographic and socioeconomic changes. Popkin (2006) has characterised the transition in five stages:

1. Collecting food (hunter-gatherers; diets were plant-based and varied; few nutritional deficiencies existed)
2. Famine (beginning of agriculture; diets were dominated by cereals and less varied; nutritional deficiencies emerged)
3. Receding famine (a second agricultural revolution; dependence on cereals declined as more FV and animal proteins are added, but the diversity of the diet remains low; the prevalence of deficiencies diminishes but some nutrition problems persist)
4. Degenerative disease (jobs and leisure activities become less active; diets are dominated by fats, sugars, processed foods, and other energy-dense foods; consumption of FV and fibre declines; overweight, obesity, and associated diet-related non-communicable diseases (NCDs) emerge)

5. Behavioural change (leisure exercise increases; higher-quality fats, whole grains, and FV become the dietary staples; reductions in body fat and obesity take place)

Current academic research is focused on the last three stages, as these stages characterise those relevant for the majority of the global population (Popkin, 2006). In particular, analysts have concentrated on understanding the transition from stage three to stage four. During this particular transition, greater accessibility to energy-dense foods gives rise to excess dietary energy intake, while urbanisation, motorisation, mechanisation and increased reliance on computers leads to the adoption of sedentary lifestyles (Popkin, 2006; Swinburn et al., 2011).

Three global trends in the last forty years have motivated the considerable attention on the transition from stage three to stage four (Popkin & Gordon-Larsen, 2004). First, as noted above, the shift towards overweight/obesity is a global problem, affecting countries at all levels of development, with acute and chronic impacts on nutrition and health. A rise in obesity prevalence in adults and children began in most high-income countries in the 1970s and 1980s (Sassi, Devaux, Cecchini, & Rusticelli, 2009). Since then, most middle-income and many low-income countries have followed suit and also experienced a rapid rise in obesity prevalence (Finucane et al., 2011). By 2008, an estimated 1.46 billion adults worldwide were overweight and another 502 million were obese (Finucane et al., 2011). Furthermore, 10% of the world's school-aged children (5-17 years) and 6.7% of preschool-aged children (0-5 years) are estimated to be overweight or obese (de Onis, Blo, & Borghi, 2010; Lobstein, Baur, & Uauy, 2004).

Second, the increase in obesity prevalence appears to be greater in low- and middle-income countries than high-income countries. Data from several low- and middle-income countries (e.g. Mexico, Thailand, China, and Indonesia) suggest that overweight/obesity is rising annually by greater than 1% a year, a rate experienced in few high-income countries (Popkin, 2006).

Third, as with undernutrition, the burden of overweight/obesity disproportionately affects the poor. In low-income countries, where lack of food and high energy expenditure remain common, the wealthy are typically the first to experience overweight/obesity, but as economies grow and per capita income rises, the burden of overweight/obesity shifts to poorer populations (Monteiro, Conde, Lu, & Popkin, 2004). However, the level of economic prosperity does not have to be high for overweight/obesity to manifest (Monteiro et al., 2004), as evidenced by the very high levels of overweight/obesity in several Pacific Island nations (Finucane et al., 2011). This disproportionate burden on the poor is likely related to lower levels of education and health-related knowledge, fewer opportunities for recreational exercise, and more limited access to nutritious foods with low energy densities (e.g. fruits, vegetables, and whole grains) (Monteiro et al., 2004).

The rapid progression of overweight/obesity in countries at all levels of development often is attributed to changes in food systems that have made energy-dense foods more available, affordable, and desirable to consumers (Hawkes, 2007; Swinburn et al., 2011). These changes have been motivated by interrelated supply and demand-side drivers, many of which are linked to ‘immensely complex’ processes of urbanization and globalization (Rayner, Hawkes, Lang, & Bello, 2006). Advanced technology and more liberal trade and investment markets have changed the cost and nature of food available to consumers – the food supply – by contributing to changes at all stages of the food system. Of particular importance has been the growth of transnational food companies, which have increased the availability of energy-dense processed foods (e.g. fast foods, snacks, soft drinks) through the growth of food processing companies, fast food outlets, and supermarkets. At the same time, the globalisation of food advertising and promotion, coupled with technological developments, cultural changes, higher incomes, and shifting employment patterns have played a role in transforming what foods consumers find acceptable with important implications for demand. The result has been a trend toward food environments characterised as ‘obesogenic’ (Chopra, Galbraith, & Darnton-Hill, 2002; Hawkes, Friel, Lobstein,

& Lang, 2012; Hawkes, 2007; Popkin, 2006; Swinburn et al., 2011). Given the broad array of changing influences, Lang and Rayner (2007) argue that this process actually reflects three overlapping transitions (rather than a single transition as described by the nutrition transition framework): a dietary transition, a cultural transition, and a transition in the way humans interface with the physical environment.

Excess dietary energy intake has become an important global health concern because overweight/obesity is a major risk factor for diet-related NCDs, such as cardiovascular disease, cancer, and diabetes mellitus. Although commonly considered ‘diseases of affluence’, the global burden of NCDs is increasing and rapidly shifting to low- and middle-income countries, paralleling trends in overweight/obesity (Ezzati et al., 2005). While total numbers of NCD deaths are increasing in all world regions, four in five of these deaths are in low- and middle-income countries (WHO, 2005b, 2009). Globally, the number of deaths attributed to NCDs now exceeds those from all infectious diseases, maternal conditions, and nutritional deficiencies combined (WHO, 2005a).

Acknowledging the growing problem of NCDs, in 2004, all member states of the World Health Organization (WHO) endorsed the Global Strategy on Diet, Physical Activity, and Health (WHO, 2004). Seven years later, continued concern over NCDs prompted the United Nations to convene a high level meeting on NCDs (only the second ever such meeting on a health issue) to discuss measures to prevent and control the global epidemic and to highlight the need to accelerate policy action (United Nations General Assembly, 2012). However, the international response has been slow. For example, a recent review of national policies to promote healthy diet and physical activity in the 140 low- and middle-income member states of the WHO identified under half to have strategies addressing intake of salt, fat, or FV or the promotion of physical activity. The review found only 36 countries to have national policy documents containing strategies to

increase FV intake, most of which focused on the use of public education and demonstrations.

Just 17 of the countries have national targets for increasing FV intake (Lachat et al., 2013).

1.3 The role of FV in the diet

FV are a vital component of a healthy and varied diet. They are high in a range of vitamins, minerals, phytochemicals, and dietary fibre, and low in energy density. The FV food group encompasses a heterogeneous assortment of foods of plant origin, including stems, leaves, fruit, seeds, and roots. The concentration of potentially important dietary components in any one fruit or vegetable product depends on numerous factors, including the variant of product, agronomic practices, environmental conditions, post-harvest handling and storage, and preparation method (Tomás-Barberán & Gil, 2008). As there remains uncertainty concerning which type and what amount of FV would confer the greatest benefits for health (Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014; Tomás-Barberán & Gil, 2008), public health research proposes that individuals should eat a wide range of fruits and vegetables in their diet, and thus health promotion approaches treat FV as a single entity (Lock, Pomerleau, Causer, Altmann, & McKee, 2005; Pomerleau, Lock, McKee, & Altmann, 2004). Of note, starchy roots and tubers, such as potato, cassava, and yams, are generally excluded from classifications (Ruel, Minot, & Smith, 2005; WCRF/AICR, 2007), but internationally there is no agreed taxonomy (Pomerleau et al., 2004).

Low FV intake is a major risk factor for both micronutrient deficiency and the most important NCDs. There is strong evidence that increasing consumption of FV reduces the risk of cardiovascular disease (Boeing et al., 2012; WHO & FAO, 2003) and probable evidence that risk of some cancers is inversely associated with FV intake (Boeing et al., 2012; WCRF/AICR, 2007; WHO & FAO, 2003). Being low in energy density, FV also are likely to protect against weight gain (Boeing et al., 2012; WCRF/AICR, 2007). The most recent global burden of disease analysis estimated that 4.9 million deaths per year were attributable to low fruit intake and a further 1.8 million were attributable to insufficient vegetable intake (Lim et al., 2012). In 2005, it

was estimated that increasing individual FV consumption to 600 g/person/day could reduce worldwide burden of disease for ischaemic heart disease by 31%, stroke by 19%, and stomach and oesophageal cancers by 19% and 20%, respectively (Lock et al., 2005).

Evidence of the protective effects of FV has led several national and international bodies to advocate dietary intake of at least 400 g/person/day (WCRF/AICR, 2007; WHO & FAO, 2003), with some governments advising substantially more (Department for Health and Ageing, n.d.). Yet, only a small minority of the world's population consumes this recommended daily minimum amount, and populations in low-income countries have the lowest FV intake levels (Lock et al., 2005; Ruel et al., 2005; Vainio & Bianchini, 2003). A review of nationally representative data in 21, mostly developed countries, found only three achieved per capita consumption of 400 g/day (Vainio & Bianchini, 2003). Similarly, a review of diet data from ten sub-Saharan African countries identified inadequate consumption in all (Ruel et al., 2005).

1.4 Determinants of FV intake

Eating behaviour results from the complex interplay of multiple influences. Contemporary public health adopts an ecological perspective to understand what people eat. Ecological frameworks emphasise two key concepts: multiple layers of influence on human behaviour and reciprocal causation (i.e. individual behaviour shapes and is shaped by the environment) (Glanz & Rimer, 2005; Lang & Rayner, 2012; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). Ecological models of the determinants of health, such as Dahlgren and Whitehead's (2007) representation, are useful to guide research and intervention efforts related to eating behaviour because they encourage the study of diverse levels of influence, especially those outside the immediate control of individuals, and are inherently interdisciplinary. The Dahlgren and Whitehead model (2007) illustrates the main influences on health as a series of layers. The outer-most layer represents the major socio-economic, cultural, and structural environment. The next layer shows the conditions in which people live and work, determined by various sectors, such as agriculture, education,

housing, health care, and so on. Situated within this are social and community networks which provide support. Finally are lifestyle decisions taken by individuals, such as the foods they choose to eat, and decisions about tobacco and alcohol consumption. The model also acknowledges fixed personal factors over which an individual has little control, such as genetic make-up, sex, and age.

Most evidence on the determinants of FV consumption originates from research in high-income countries, however this PhD thesis focuses on factors of particular importance to low-income countries. In all settings, factors that affect FV intake can be considered in two dimensions: influences on what consumers are able to acquire and consume and influences on what they choose to acquire and consume (Pollard, Kirk, & Cade, 2002; Ruel et al., 2005). A 2005 review on the determinants of FV intake in developing countries identified household income, prices and availability, consumer preferences, home production, and intrahousehold decision-making to be the most important (Ruel et al., 2005). A brief, general overview of the links between each of these factors and FV intake is provided below.

1.4.1 Income

Income and FV consumption are positively correlated, with higher income associated with an increase in both the volume and the diversity of FV consumed (Kamphuis et al., 2006; Pollard et al., 2002; Rasmussen et al., 2006; Ruel et al., 2005; Seale Jr., Regmi, & Bernstein, 2003). The responsiveness of FV demand to changes in income is measured by income elasticity of demand, calculated as the ratio percentage change in demand to the ratio percentage change in income. When income elasticity is negative, an increase in income will lead to a fall in demand; when it is positive, an increase in income will lead to a rise in demand. Using data from the World Bank's International Comparison Project (ICP), Seale et al. (2003) estimated the effect of income on demand in 114 countries. They found income elasticity of demand for FV to be 0.60-0.70 in most low-income countries, 0.40-0.58 in most middle income countries, and 0.10-0.40 in most high-

income nations (Seale Jr. et al., 2003), indicating rises in income are associated with greater increases in demand for FV in poorer compared to richer countries.

1.4.2 Availability

Strong evidence for the importance of FV availability as a major determinant of intake has been identified in several reviews (Kamphuis et al., 2006; Krolner et al., 2011; Pollard et al., 2002; Rasmussen et al., 2006; Ruel et al., 2005). In high and middle income countries, increased imports and the adoption of technologies that extend the harvest period or facilitate transport or storage has meant that many varieties of FV have year-round availability (Pollard et al., 2002); however, in poor countries, where infrastructure is more limited, many FV are not available at all during part of the year (Ruel et al., 2005) or prices are unaffordable to poor consumers (Ali & Tsou, 1997).

1.4.3 Price

Price is one of the most influential factors in food choice, particularly for the poor. Using the ICP data, Seale et al. (2003) also estimated the effect of prices on demand for FV. Their analysis found most own-price elasticities of demand for FV ranging from -0.57 to -0.47 in most low-income countries, -0.46 to -0.33 in most middle income countries, and -0.32 to 0.07 in most high-income countries, indicating that increased FV prices are associated with a fall in demand. Findings from a recent systematic review of food price elasticities identified an even stronger effect on low-income countries compared to high-income countries and also identified that demand for food was more responsive to price changes amongst lower income households within countries (Green et al., 2013).

1.4.4 Consumer preferences

Once they have satisfied their basic energy needs, households start diversifying their diets, and consumer preferences exert greater influence in decisions about what is eaten. This is characteristic of a progression from stage three to stage four in the nutrition transition framework

(Popkin, 2006). Consumer preferences are shaped not only by personal factors, but also social and cultural factors. Food beliefs and behaviours are underpinned by food culture, or “a constellation of socially produced values, attitudes, relationships, tastes, cuisines and practices exhibited through food” (Lang & Heasman, 2004, p. 185). Several reviews, focusing on developed countries have explored preferences for FV in adults (Brunsø, Fjord, & Grunert, 2002; Pollard et al., 2002) and children (Krolner et al., 2011; Rasmussen et al., 2006). Common factors identified to contribute to preferences include sensory appeal (particularly taste and appearance), perceived health benefit, convenience, familiarity and habit, social desirability, media and advertising, and considerations of how the food was produced. Very little is known about how consumer preferences influence FV consumption in low-income countries; however Ruel et al. (2005) suggest that taboos and cultural beliefs are likely to be particularly important, especially for select population groups, such as pregnant and lactating women and infants.

1.4.5 Home production

For consumers in low-income countries, where food often constitutes half of total household expenditure and FV can represent 10-25% of the food budget (Seale Jr. et al., 2003), growing food at home can be less costly and more feasible than purchasing FV (Ruel et al., 2005). This may be the case particularly where markets are inefficient and/or transportation costs are high. There is ample evidence to support this theory, especially from evaluations of home gardening initiatives. Such studies have demonstrated that homestead food production interventions – particularly those that incorporate education and behaviour change activities – increase intake of FV and micronutrients (Faber, Phungula, Venter, Dhansay, & Spinnler Benadé, 2002; Iannotti, Cunningham, & Ruel, 2009). Potential constraints to home production include access to labour, water, information, capital, stocks of appropriate plants and livestock, and land (Mitchell & Hanstad, 2004; Ruel et al., 2005); however even a very small garden can meet a substantial

proportion of a household's micronutrient requirements if densely planted (Ali & Tsou, 1997). Cultural acceptance is also an important factor for home gardening (Mitchell & Hanstad, 2004).

1.4.6 Intrahousehold decision-making

Ruel et al. (2005) hypothesise a relationship between female status and FV consumption, based on strong evidence linking intrahousehold decision-making and child nutrition, which has found that households in which women have greater control over resources and social status tend to place a higher priority on child health in allocating resources (Meinzen-Dick, Behrman, Menon, & Quisumbing, 2011; Quisumbing, 2003; Smith, Ramakrishnan, Ndiaye, Haddad, & Martorell, 2002). For example, research across South Asia identified a strong association between women's status and stunting and wasting in children (Smith et al., 2002). For this reason, initiatives to promote home production of FV have targeted women (Bushamuka et al., 2005; Fan & Pandya-Lorch, 2012; Iannotti et al., 2009). However, the link between intrahousehold decision-making and FV consumption remains a topic for further research.

1.5 Interventions to increase FV intake

In order to change dietary intake of FV, all factors involved need to be considered, including food production, processing, the retail environment, and consumer demand. However, most public health intervention research to date has concentrated on consumers and how to influence them (rather than altering the food supply or food environment). Efforts to increase FV intake commonly have focused on behaviour change communication and involved providing information, education, literacy, and skills training. The primary aim of such programmes is to equip individuals with knowledge and tools that will empower them to change their behaviour in ways that are consistent with good health.

Evidence on the effectiveness of interventions to increase FV intake has been summarised through several systematic reviews (Ammerman, Lindquist, Lohr, & Hersey, 2002; Knai,

Pomerleau, Lock, & McKee, 2006; Pomerleau, Lock, Knai, & McKee, 2005; Thomson & Ravia, 2011). Most evaluated studies examine the effect of behaviour change communication, with or without other intervention activities. The majority do show encouraging effects on FV intake, but the changes observed tend to be small in comparison to the increase necessary to achieve recommended levels of intake. Further, nearly all evidence comes from industrialised countries and most interventions have a relatively short follow-up time and do not provide information on the long-term impact. For example, a systematic review by Pomerleau et al. (2005) examined evidence on the effectiveness of interventions and programmes to promote FV intake amongst adults. Although not limited by world region, over three quarters of the 44 papers identified reported on interventions in the United States or Europe. The review found FV intake to increase by 0.1 to 1.4 servings per person per day. Consistent with earlier research (Ammerman et al., 2002), the largest changes were observed in populations with pre-existing health conditions. A parallel review by the same authors to examine the effectiveness of interventions and programmes to increase FV intake amongst children and adolescents found a similar effect (0.3 to 0.99 servings per person per day). The strongest effects were observed from interventions that included both educational and environmental components, involved the whole school community, and lasted at least 12 months (Knai et al., 2006).

Behaviour change communications campaigns appear to be critical, but not sufficient to increase FV intake, as healthy food choices can only occur within a supportive environment with available and affordable options (Story et al., 2008; Swinburn, Egger, & Raza, 1999). Recognition is growing that macro-level or upstream changes are needed to create healthy food environments (Chopra et al., 2002; Lang & Rayner, 2007; Nugent, 2004; Snowdon, Lawrence, Schultz, Vivili, & Swinburn, 2010; Story et al., 2008; Swinburn et al., 2011, 2013) and research on this topic is expanding rapidly and appears promising (Mozaffarian et al., 2012); however there remains a paucity of evidence on the most-promising (Hawkes, Jewell, & Allen, 2013; Swinburn et al.,

2013) and cost-effective (Cobiac, Vos, & Veerman, 2010; Dallongeville, Dauchet, de Mouzon, Requillart, & Soler, 2011) options.

Population-level dietary intervention typically involves policy changes at the local, national, or international level. The American Heart Association recently reviewed evidence on population approaches to improve diet. This review identified the interventions most effective at changing diets to be subsidies to lower the prices of healthy foods (e.g. FV), multi-component strategies in schools (incorporating diet and physical activity), restrictions on television advertising of less healthy foods and beverages to children, mandatory regulation to reduce some nutrients in processed foods (e.g. trans fats and salt), and sustained, focused multi-component media and educational campaigns. The authors noted that many other interventions are likely to be helpful, especially those related to changing the food environment, but have not sufficiently been evaluated (Mozaffarian et al., 2012).

1.6 Agri-food systems and nutrition and health

Changing diets to improve population nutrition and health will require a multi-faceted, concerted, and cross-sectoral approach (Chopra et al., 2002; Dahlgren & Whitehead, 2007; Lang & Heasman, 2004; Lang & Rayner, 2007; WHO, 2004) and both direct and indirect action. Direct action (sometimes referred to as ‘nutrition-specific’ action) involves the scaling up of effective nutrition policies and programmes. Indirect action refers to increasing the ‘nutrition sensitivity’ of activities in other related sectors, including agriculture, trade, and transportation.

Leveraging agri-food systems for improved nutrition and health has been a strong focus of the development community in recent years (Fan & Pandya-Lorch, 2012; Hawkes & Ruel, 2011; Henson, Humphrey, & McClafferty, 2013; Herforth, Jones, & Pistrup-Andersen, 2012; Herforth, 2013), as it is recognised that these systems could more effectively provide a nutritious, high-quality, acceptable food supply. Agricultural programmes and policies generally attract much

greater resource flows than those designated specifically for nutrition, therefore increasing their nutrition-sensitivity provides a promising vehicle for addressing nutrition problems (Dangour et al., 2013) as well as the economic and environmental issues they are traditionally designed to address.

Despite clear potential (Friel et al., 2009; Hawkes et al., 2012; Lock et al., 2010) and high levels of interest, there remains a lack of policy-relevant evidence on the best possible opportunities to leverage or re-orient agri-food systems to support healthier diets and nutrition (Berti et al., 2003; Dangour et al., 2013; Masset et al., 2012; Ruel et al., 2013). Therefore, a first step is to understand the current food supply, dietary patterns, and drivers of demand. What makes nutritious foods comparatively less appealing? Are they unavailable, unaffordable, or in some way unacceptable to the population? What could be done to improve on these shortcomings and optimise the supply of healthy foods?

Nutrition-oriented value chain analysis¹ is one approach that has been proposed for studying agri-food systems from a nutrition perspective and considering these questions. It involves examining the supply chain for a specific food product in a structured way to uncover untapped opportunities to increase the value for consumers (Hawkes & Ruel, 2011).

1.7 Aim and objectives

This thesis aims to identify the strengths, limitations, and potential of nutrition-oriented value chain analysis to inform policy and programmes to increase FV intake. It sets out to achieve this through a case study of the FV sector in Fiji, where suboptimal FV intake (Cornelius et al., 2002; Ministry of Health, 2014) and rising rates of diet-related chronic disease have been identified (WHO, 2011). Within this broad aim, the research has four specific objectives:

¹ The phrase ‘nutrition-oriented value chain analysis’ was first coined by Hattersley (2013) in her research on the Australian canned fruit industry.

1. To review the major theoretical and methodological approaches which have influenced development of nutrition-oriented value chain analysis;
2. To identify what urban Fijian consumers value in FVs;
3. To map exemplar FV value chains, and identify the value chain activities and actors; and
4. To identify why the exemplar value chains are organised and function as they do, and how this contributes to product availability, affordability, and acceptability.

1.8 Outline of the thesis

This thesis is comprised of nine chapters. To provide context for the research and familiarise the reader with the research site, the next chapter (Chapter Two) provides a brief background on Fiji and its food environment, and reviews the most recent local evidence on FV availability and consumption. Chapter Three critically reviews the major theoretical and methodological traditions of value chain research and the nascent field of nutrition-oriented value chains research. The purpose of this literature review is to inform the development of a suitable approach for a nutrition-oriented value chain analysis of FV value chains.

Chapter Four outlines and discusses the research design developed. The first half of the chapter focuses on the theoretical and conceptual frameworks underpinning the research, as well as the methodological approach applied. This is followed by a discussion of site selection and the specific research methods and techniques used in the collection and analysis of data.

The empirical research findings are presented in Chapters Five, Six, Seven, and Eight. Chapter Five presents the results of the consumer research aimed at exploring perceptions of FV value. Chapter Six outlines the selection of three exemplar chains and describes how those chains are structured and the range of activities involved in each to bring a product to urban consumers in Fiji. Chapter Seven provides a structured value chain analysis focused around three core issues:

material flow, information flow, and relationships. Chapter Eight discusses hazards to the FV sector and the ways in which value chain actors respond to or prepare for them.

Chapter Nine summarises and discusses the research findings and their implications for Fiji. The method is also reviewed, including limitations and potential areas for future research. The final section offers a brief conclusion.

CHAPTER TWO: FIJI AND THE FOOD ENVIRONMENT

2.1 Introduction

This chapter provides an introduction to the case study country, Fiji, the local food environment, and what is currently known about FV availability and consumption. It is divided into six sections. Section 2.2 offers basic information on Fiji's geography and the Fijian people. Section 2.3 provides a brief overview of the country's history, political system, and economy, with a focus on policies with implications for the modern agri-food system. Sections 2.4 and 2.5 introduce the health, food intake, and nutrition situations. Section 2.6 provides the most recent evidence on FV availability and consumption in Fiji. This is followed by a brief conclusion (Section 2.7).

2.2 Geography and population

Fiji is an island nation in the South Pacific Ocean located between latitudes 15°S and 22°S and longitudes 177° E and 178° W (Figure 1). The country comprises an archipelago of approximately 332 islands and has a total land mass of about 18300 km², which is slightly smaller than Wales in the United Kingdom. Most of the islands are volcanic in origin and the largest islands are mountainous. Approximately one third of islands are populated. Viti Levu ('Big Fiji') is the largest island and home to 80% of the total population of around 837,300 (FIBoS, 2008a). The second largest island, Vanua Levu is half the size of Viti Levu. The capital, Suva, is located in south eastern Viti Levu.

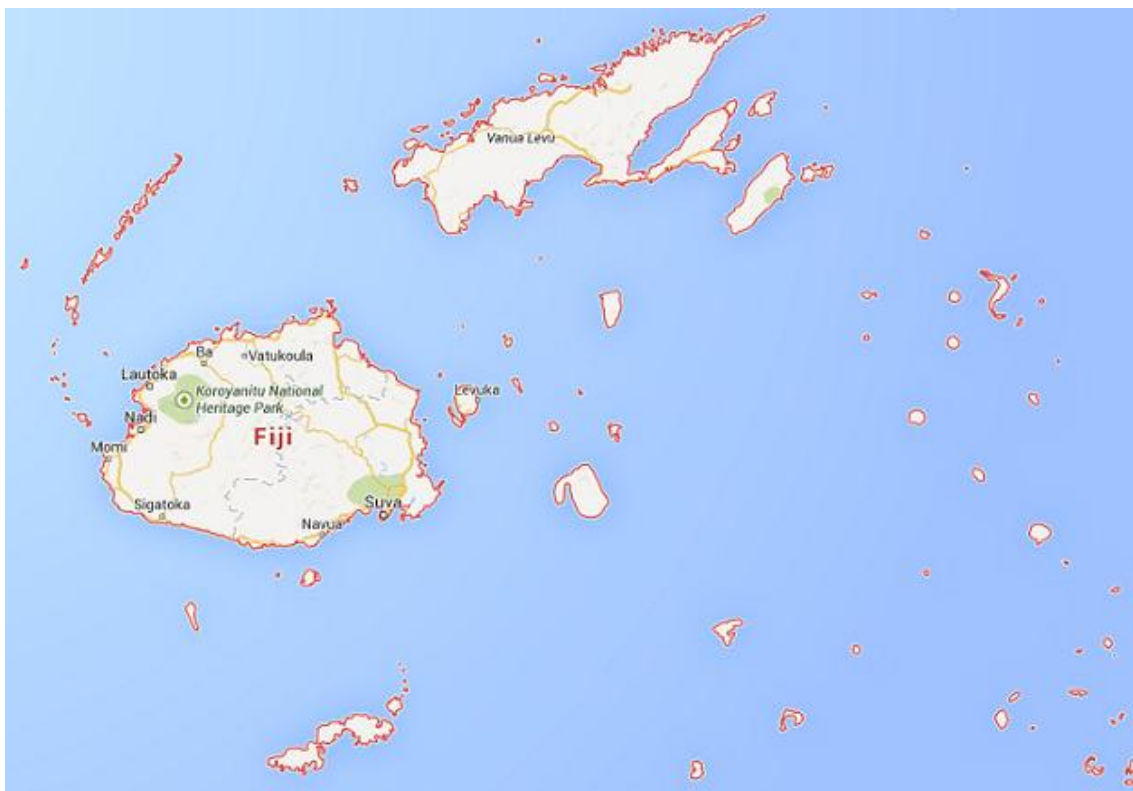


Figure 1. Republic of the Fiji Islands

Source: Google (2014)

Fiji's climate is tropical and maritime, with a distinct dry season (May to October) and rainy season (November to April). As well as seasonal variations, there is also a high degree of inter-annual variability in rainfall. As with other small island developing states, Fiji's small size and remote location introduce a range of special challenges, including a fragile environment, limited resources, dependence on international trade, and high vulnerability to natural disasters and climate change (UN-OHRLLS, 2014). In particular, Fiji is affected by tropical cyclones and depressions. Between 1969 and 2010, the centre of 70 cyclones passed within 400 km of Suva (Australian Bureau of Meteorology & CSIRO, 2011).

Fiji has a multi-cultural society of peoples of indigenous Fijian ('iTaukei') (56.7%), Indian (37.5%), European, Chinese, Korean, and other Pacific Islander descent (FIBoS, 2008). Rural-urban migration is rapidly increasing urban areas. In 1966, one third of the population lived in

urban areas, compared to over half today. Most of this growth has been in the greater Suva area (FIBoS, 2008). Poverty affects approximately one-third of the population (Narsey, Raikoti, & Waqavonovono, 2010). In recent years, urban poverty has significantly declined, whilst rural poverty has increased. Nationally, the gap between the rich and poor is widening (Narsey et al., 2010).

2.3 History, political system, and economy

Most authorities agree that the first settlers of Fiji were of Polynesian and Melanesian descent. These peoples created a highly developed society organised into clans by residence and kinship, each led by a chief. Fijians had little contact with Europeans until the first half of the nineteenth century when the ‘discovery’ of sandalwood and beche-de-mer (sea cucumber) attracted European, Australian, and American traders, with Christian missionaries soon following. This trading led to the rise in power of some Fijian chiefs over others and exacerbated rivalries between different native confederacies. One chief, Cakobau, an early Christian convert and champion of the missionaries, grew highly influential amongst native chiefs and instrumental in Fiji’s dealings with Europeans. Due to domestic and international pressures, Cakobau eventually ceded Fiji to Britain in 1874, in the presence of other chiefs. By the late nineteenth century, large numbers of British had settled in Fiji, establishing first a thriving cotton industry and then sugarcane industry (Lal, 1992). In 1970, Fiji became an independent, democratic nation within the British Commonwealth.

Amongst the many significant impacts of colonial rule, two policies set in place by Fiji’s first British governors have been particularly influential for modern politics and agriculture: labour laws were enacted that banned the exploitation of iTaukei as labourers on European plantations and land laws were formulated that prohibited further sales of native land. Both policies were established to protect the values and ways of living of Fiji’s indigenous population. To address the tremendous labour shortage on the sugarcane plantations, the British governors established a

system to bring indentured workers from India. The indenture system was in place between 1879 and 1916 and brought 60,639 Indian women, men, and children to the islands (Lal, 1992). Per the terms of the ten-year labour contracts, Indians agreed to cut sugarcane for a plantation owner for five years, after which they were allowed to lease small plots of their own from the iTaukei to plant cane or livestock for a further five years (Stanley, 1996). Following expiration of their contracts, most of those Indians stayed on as tenant farmers and businessmen (Robertson, 1990) and by the mid-twentieth century the Indian population outnumbered the iTaukei population (FIBoS, 2012a).

Fiji's land ownership and tenure system is complex and has been a source of extensive political and social debate. Of the total land area, 7.5% is held by the government, 10% is held as freehold, and 82.5% is native land. Native land is inalienable and cannot be sold, mortgaged, or transferred, but may be leased. From 1880 to 1976, lease arrangements were subject to varying degrees of discretion and negotiation; however, as many tenants had few options, they were often disadvantaged (Naidu & Reddy, 2002). In 1976, the Agricultural and Landlord Tenants Act (ALTA) was established to rationalise leasing of land for agriculture. Under ALTA, tenants are given 30-year fixed leases at set prices managed by the Native Land Trust Board (NLTB). Expiration of the first ALTA leases began in 1997, with high instances of lease non-renewal. Thousands of former leaseholders, who are predominantly of Indian descent, have been forced to move and find alternative livelihoods (Naidu & Reddy, 2002). Between 1997 and 2028, a total of 13,140 leases will expire (UNCCD National Focal Point, 2007).

Since independence, ethnic and other tensions have led to four coups: two in 1987, one in 2000, and one in 2006. The coups have had drastic effects on the economy and society. International disapproval has been expressed through trade sanctions, cuts to development aid, travel warnings, sporting boycotts, and suspension of Fiji from the Commonwealth. Many Fijians of Indian descent – particularly the highly educated and wealthy – have migrated overseas, causing a severe

loss of skilled labour (Robertson, 1990). In 1986, Fijians of Indian descent comprised 48.7% of the total population, but by 2007 this figure had fallen to 37.5% (FIBoS, 2012a). Since 1987, the military has either been ruling directly, or heavily influencing government. At the time of fieldwork, Fiji was under military leadership.

Fiji's economy is heavily dependent on the success of agricultural exports, tourism and international donors. In 2012, Fiji had a gross domestic product (GDP) of FJ\$5.6 billion (approximately £1.8 billion), to which agriculture contributed 9.6% (FIBoS, 2012b). Sugar has historically been the most important export, although in recent years the industry has struggled with domestic and international problems, including the expiration of agricultural leases, declining productivity, high costs, natural disasters, and the loss of preferential access to the European Union.

2.4 Health

Fiji's health profile compares well with other Pacific Island nations. The country has a government-funded public health care system and spends 2.9-3.5% of GDP on health (Roberts et al., 2011). Life expectancy has risen in recent decades and now stands at 68 years for males and 72 years for females. Infant and child mortality rates, the mortality ratio, and the incidence of low birth weight all have declined (WHO, 2011).

As with many developing countries, Fiji suffers the double burden of communicable and non-communicable disease. Infectious and parasitic diseases continue to be a concern, while NCDs are rising. Diabetes is the leading cause of morbidity and cardiovascular disease is the leading cause of mortality, although disease risk varies by ethnicity (Cornelius et al., 2002; WHO, 2011). In a recent national survey, 74.7% of adult women and 59.4% of adult men were identified to be overweight or obese (Ministry of Health, 2014). There were large differences between the two main ethnic groups, with significantly lower prevalence of obesity amongst Fijians of Indian

descent than iTaukeis. Concern over the rising burden of NCDs has led to increased government attention and financial commitment (Ministry of Health, 2010a; WHO, 2011).

2.5 Food and nutrition

Historical evidence suggests that, pre-European contact, the people of Fiji were almost entirely self-sufficient in food (Thaman, 1990). Thaman (1990) attributes the independence, resilience, and sustainability of the food system over millennia to traditional production practices characterised by extensive shifting combined with hunting and gathering marine resources and wild plant and animal foods, inter-island trade and food exchange networks, and traditional food processing and preservation technologies. At the time of European contact, Pacific Islanders were reported to have good nutritional status and be generally robust, physically fit, and healthy (Coyne, 2000; Thaman, 1990).

With European contact came profound shifts in diets and lifestyles. The introduction of a cash economy reduced engagement with subsistence production and increased dependence on purchased foods. Immigration, the emphasis of colonial and present governments on cash cropping and plantation production, and increasing urbanisation have contributed further to reliance on imported foods (Coyne, 2000; Thaman, 1990). Survey data dating back to the 1950s indicate a steady move from traditional foods to introduced cash crops and imported and processed foods (Parkinson, 1990; Schultz, Vatucawaqa, & Tuivaga, 2007). This dietary evidence is supported by importation data and household income and expenditure data, which reveal dramatic increases in both food importation (Vatucawaqa, 2012) and household spending on imported foods compared to local foods (Narsey, 2011a). For example, between 1999 and 2009, availability of dietary energy from imported foods increased from 55% to 68% (Vatucawaqa, 2012). Consumption of processed savoury snack foods (e.g. crisps) is rapidly rising (Narsey, 2011a) and fast food outlets are now commonplace.

In 2010, Fiji was one of the 21 Pacific countries to endorse the region's Framework for Action on Food Security (Pacific Food Summit, 2010; WHO, 2010). To address trade vulnerability and improve local food security and nutrition, the Government of Fiji has called for a stronger focus on increasing the proportion of locally produced foods in diets. In the past decade, agricultural policy has shifted from an export-oriented position to emphasising the importance of promoting both exports and increased agricultural self-sufficiency through 'import substitution' (the consumption of domestic rather than imported goods) (Ministry of Primary Industry, 2009). This has been paralleled by public health targets to reduce consumption of imported foods and increase consumption of local FV (Ministry of Health, 2010b; National FPAN Advisory Committee, 2010; NFNC, 2008b). A high profile example of policy action taken by the Government of Fiji to address trade and health concerns related to food importation was a ban on sales of mutton flaps (fatty off-cuts, mostly imported from New Zealand) in 2000. The ban greatly reduced the import and sale of mutton flaps, however did not address the availability of other substitutable fatty meats (Thow, Swinburn, et al., 2010).

Nutrition has been long-recognised as important in Fiji and since 1982 the National Food and Nutrition Centre (NFNC) had monitored the food and nutrition situation and sought to address nutrition concerns. The NFNC is a special centre within the Ministry of Health tasked with "coordinating and monitoring food and nutrition activities and advising stakeholders on the food and nutrition situation" (NFNC, 2008a). Amongst other activities, the NFNC has led the development of national plans of action and policy on nutrition (National FPAN Advisory Committee, 2010; NFNC, 2008b) and overseen annual compilation of Food Balance Sheets (FBS) and a decennial National Nutrition Survey (NNS).

2.6 Fruit and vegetable availability and consumption

This thesis focuses on FV availability and consumption in Fiji, and this section specifically reviews available recent evidence on the topic. To explore local FV availability and prices,

national FBS data for years 1992-2009 (last year available) and retail price data for selected FV products (amaranthus, carrots, papaya, and tomatoes) at Suva Market from January 2011 to January 2013 were obtained from the NFNC and Department of Agriculture, respectively. To examine consumption, findings from the 2011 NCD STEPs survey are considered, and food frequency data from the 2004 NNS are descriptively reviewed. To gain access to the NNS dataset, the PhD candidate submitted a formal request to the Permanent Secretary for Health. Ethical approval to use the NNS data also was acquired (see Chapter Four).

2.6.1 Availability and prices

In Fiji, FBS statistics have been compiled annually by the NFNC since 1992 using data sourced from the Ministry of Agriculture and Fiji Islands Bureau of Statistics (FIBoS) (Vatucawaqa, 2012). Food balance equates to the commercial production of food in a country plus food imports (adjusted for changes in stocks), minus exports, foods fed to livestock, used as seed, manufactured into non-food (e.g. paint) or minimally-nutritious food products (e.g. sweets), and wasted. For vegetables, data are tabulated in five categories: fresh tomatoes, onions, lettuce, garlic, and other. For fruit, ten categories are specified: watermelon, pineapple, banana/plantain, passion fruit, papaya, orange/tangerine, apple, grapes, dried fruit, and fresh fruit not elsewhere specified.

FBS statistics reveal a gradual rise in the availability of kilocalories (kcal) per capita over the past two decades. In 2009, an average of 3421 kcal were available per person per day, which is in excess of minimum energy requirements (Joint FAO/WHO/ UNU Expert Consultation, 2001; Vatucawaqa, 2012). However, the FV supply volume has been consistently insufficient to support achievement of the WHO recommendation of 400 g/person/day (Figure 2). In fact, daily availability of FV has never exceeded 180 g per person, and in no year since 1992 has even a full serving (80 g) of fruit been available per person per day.

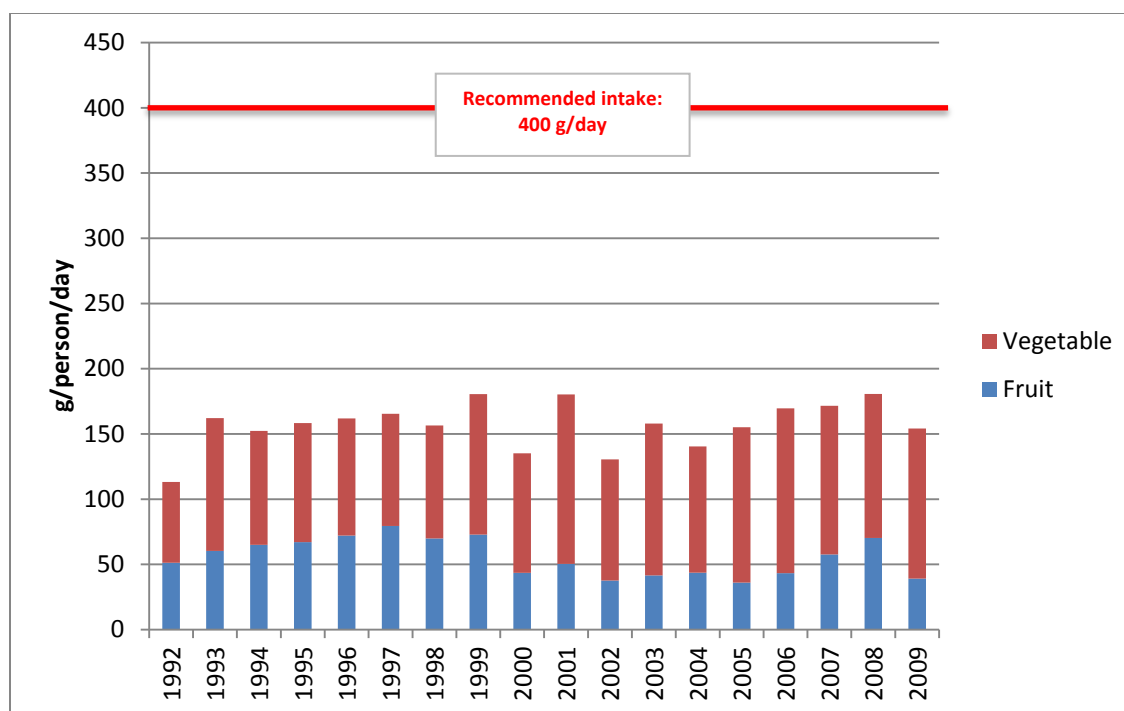


Figure 2. Average FV supply available per person per day in Fiji, 1992-2009
Data source: FBS from the NFNC, Ministry of Health

A limitation to the use of FBS data to estimate local FV availability is that they do not account for subsistence production, which is substantial in Fiji (ADB, 1996; Schultz et al., 2007) and in many less developed countries (Pomerleau, Lock, & McKee, 2003). For instance, the 2004 NNS identified over half of urban households (61.8%) and nearly all rural households (97.2%) to have food gardens (Schultz et al., 2007). However, there is clear evidence of a very rapid decline in home production in recent years, particularly in urban areas (Narsey, 2011a; Schultz et al., 2007).

The distinct seasonality of most local FV is reflected in market availability and prices. In the hotter, wetter months, limited supplies of locally-grown temperate climate FV can be found in markets, and those items that are available sell for premium prices. For example, the price of a kilogram (kg) of tomatoes can range from under FJ\$2 to over FJ\$17 depending on the season (Figure 3). Fluctuations in supply and prices also are driven in part by the fluctuating demands of the tourism industry (Young & Vinning, 2007) and export sector, as well as losses caused by

natural disasters. For instance, production of papaya – Fiji’s leading fresh fruit export – was severely damaged due to flooding in January and March 2012 and exports ceased for 15 months due to inadequate fruit volumes (Stice, 2013). Despite low papaya production, harvests were diverted to local markets, somewhat buffering local prices (Figure 3). The most consistent supply and prices tend to be observed for perennial leafy green vegetables (e.g. amaranthus) and imported products (e.g. carrots) (Figure 3).

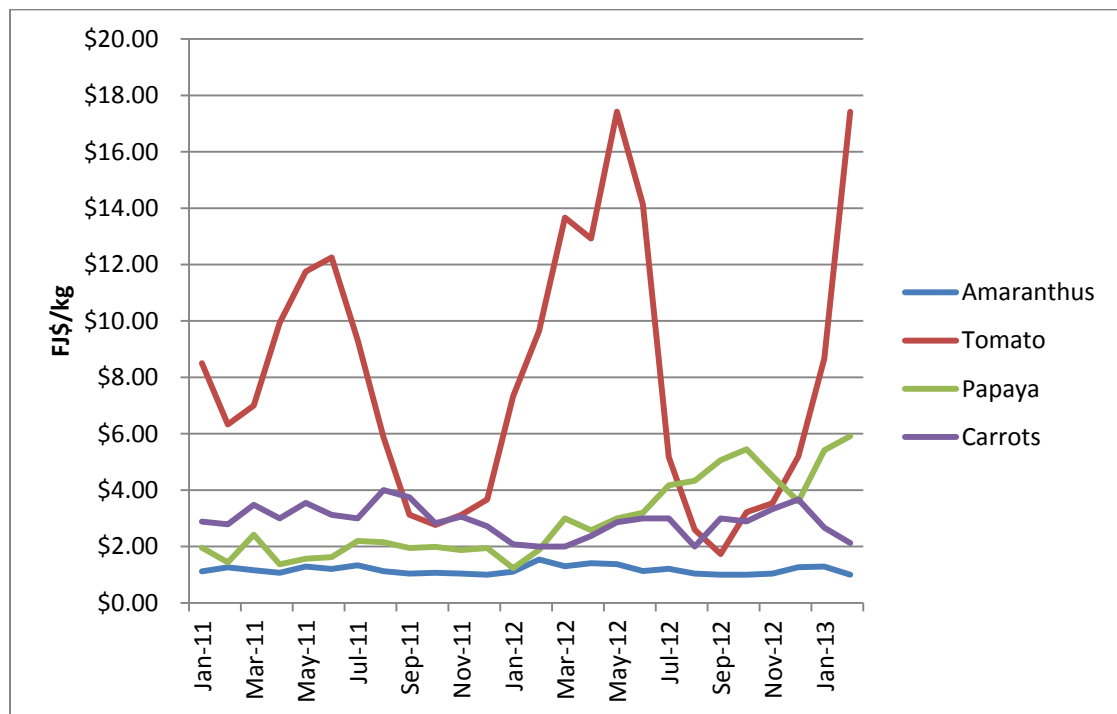


Figure 3. Retail prices for amaranthus, carrots, papaya, and tomatoes in Suva Market, 2011-2013
Data source: Department of Agriculture, Ministry of Primary Industries

2.6.2 Consumption

Fiji’s most recent nationally-representative data on FV intake comes from the WHO NCD STEPS survey of chronic disease risk factors (Ministry of Health, 2014). It has twice been implemented in Fiji, once in 2002 and again in 2011. In 2011, a total of 2,668 adults aged 25-64 participated (response rate 55%). The survey instrument assesses FV intake using four multiple choice questions and a standard serving size specification (Ministry of Health, 2014):

1. In a typical week, on how many days do you eat fruit?
2. How many servings of fruit do you eat on one of those days?
3. In a typical week, on how many days do you eat vegetables?
4. How many servings of vegetables do you eat on one of those days?

Data from both 2002 and 2011 indicate few adults meeting FV recommendations of five servings per day (Ministry of Health, 2014). In 2002, over 65% of adults consumed less than one serving of fruit per day and over 25% consumed less than a serving of vegetables (Cornelius et al., 2002). In 2011, average FV intake amongst adults was three servings per day, with only 15% of adults achieving the recommended five or more servings and 10% consuming no FV (Ministry of Health, 2014). This did not differ significantly by sex, ethnicity, or age in 2011.

The strongest evidence on the types of FV consumed in Fiji comes from the 2004 NNS. The 2004 NNS is the most recent comprehensive nutrition survey in Fiji and was designed to collect six categories of information: demographic data; anthropometric measures; biochemical data; food production and storage; dietary intake; and NCD risk factors. In 2004, data were collected nationally using two-stage systematic cluster sampling (Schultz et al., 2007); however, the survey was not nationally representative due to challenges posed by a small population spread over many islands. As part of the survey, a qualitative household-level food frequency questionnaire (FFQ) was administered to the head of household (or an adult who had knowledge of the household) for the purpose of obtaining basic descriptive data on foods consumed (Schultz et al., 2007). Unlike quantitative and semi-quantitative FFQs, qualitative questionnaires lack portion size estimates, so cannot be used to estimate intake (Sempos, 1992). The FFQ asked participants to specify usual food intake for the whole household over the past six months. In the FV section, the respondent was asked, “How often does your family/household eat these foods? If your intake varies with season, how often does your family/household have them when in season?” The respondent was then guided through a list containing 19 fruits and 25 vegetables with seven possible response

options ranging from two or more times per day to never. A sample of 1,696 households containing 7,352 persons participated in the FFQ component of the survey (Schultz et al., 2007). Households which were missing data on ethnicity or FV intake were removed from the dataset. The final sample included 1,546 households.

Households of all ethnicities were found to include a wide range of FV in the diet (Table 1).

Amongst vegetables, Chinese cabbage (*Brassica chinensis*), English cabbage (*Brassica oleracea*), taro leaves (locally termed 'rourou'; *Colocasia esculenta* var. *esculenta*), bele (*Hibiscus manihot*), pumpkin (*Cucurbita pepo*), tomato (*Lycopersicon esculentum*), eggplant (*Solanum melongena*), and mixed frozen vegetables were consumed on a daily or weekly basis when in season by over half of households of all ethnic groups. Rourou and bele are perennial crops and consistently available in Fiji. For Chinese cabbage, English cabbage, pumpkin, and tomato, major production occurs in the cool, dry months, although some supplies are available year-round. For eggplant, the most significant production takes place in the hot, wet season. Although not consumed by more than half of households of all ethnicities on a daily or weekly basis, amaranthus (*Amaranthus viridis*) and carrots (*Daucus carota*) also were consumed commonly by most households year-round.

Many fruits in Fiji have seasonal availability and are consumed primarily by just one ethnic group. However, banana (*Musa sapientum*), citrus fruits, papaya (*Carica papaya*), and mango (*Mangifera indica*) were found to be important to nearly all households in the sample. With the exception of mango which is only available half of the year, the other three fruits are available year-round.

Table 1. Availability, source, and consumption of 46 commonly consumed products in Fiji

Product	Availability and source*	% households (n=1546) that include product in diet			Consumed by >50% households of all ethnic groups on a daily or weekly basis when in season
		iTaukei (n=877)	Indian (n=633)	Other (n=36)	
Vegetables					
Leafy green vegetables					
Chinese cabbage (<i>Brassica chinesis</i>)	All year (L)	98	99	97	✓
English cabbage (<i>Brassica oleracea</i>)	All year (L)	91	99	97	✓
Rourou (<i>Colocasia esculenta</i> var. <i>esculenta</i>)	All year (L)	100	97	97	✓
Bele (<i>Hibiscus manihot</i>)	All year (L)	99	98	97	✓
Lettuce (<i>Lactuca savita</i>)	All year (L,I)	61	95	86	N
Ota (<i>Athyrium esculentum</i>)	All year (L)	91	37	86	N
Saijan (<i>Moringa oleifera</i>)	All year (L)	32	98	31	N
Amaranthus (<i>Hibiscus manihot</i>)	All year (L)	86	99	75	N
Watercress (<i>Rorippa nasturtium-aquaticum</i>)	Feb-July (L)	82	60	69	N
Red/orange/yellow vegetables					
Capsicum (<i>Capsicum annum</i>)	All year (I)	51	78	75	N
Carrot (<i>Daucus carota</i>)	All year (I)	85	99	100	N
Pumpkin (<i>Cucurbita pepo</i>)	All year (L)	96	99	100	✓
Tomato (<i>Lycopersicon esculentum</i>)	All year (L,I)	94	100	100	✓
Other vegetables					
Green bean (<i>Phaseolous aureus</i>)	All year (L)	86	100	100	N
Cucumber (<i>Cucumis sativus</i>)	All year (L)	89	99	100	N
Eggplant (<i>Solanum melongena</i>)	All year (L)	96	100	92	✓
Jackfruit (<i>Artocarpus heterophyllus</i>)	All year (L)	27	98	39	N
Bitter gourd (<i>Momordica charantia</i>)	All year (L)	15	96	19	N
Okra (<i>Hibiscus esculentus</i>)	All year (L)	32	96	39	N
Cauliflower (<i>Brassica oleracea</i> var. <i>botrytis</i>)	All year (I)	42	76	72	N
Bean sprouts (<i>Phaseolous aureus</i>)	All year (I)	38	63	69	N
Lauki (<i>Lagenaria siceraria</i>)	Apr-Sept (L)	21	85	28	N
Bora beans (<i>Vigna sinensis</i>)	All year (L)	32	98	44	N
Onions (<i>Allium cepa</i>)	All year (I)	98	99	100	N
Mixed frozen veg	All year (L,I)	100	100	100	✓
Fruit					
Red/orange/yellow fruit					
Citrus (multiple)	All year (L,I)	100	99	97	✓
Guava (<i>Psidium guajava</i>)	Jan-Apr (L)	94	98	94	N
Melon (multiple)	Sept-Mar (L)	89	99	94	N
Mango (<i>Mangifera indica</i>)	Aug-Mar (L)	96	100	100	✓
Passion fruit (<i>Passiflora edulis</i>)	All year (L)	74	92	92	N
Papaya (<i>Carica papaya</i>)	All year (L)	100	99	100	✓
Pineapple (<i>Ananas comosus</i>)	All year (L)	94	98	94	N
Other fruit					
Apple (<i>Malus domestica</i>)	All year (I)	79	100	100	N
Avocado (<i>Persea americana</i>)	Feb-Mar (L)	68	51	83	N
Banana (<i>Musa sapientum</i>)	All year (L)	100	100	94	✓
Bayr (<i>Ziziphus mauritiana</i>)	Aug-Sept (L)	30	77	39	N
Dawa (<i>Pometia pinnata</i>)	Nov (L)	72	38	67	N
Grapes (<i>Vitus vitifera</i>)	All year (I)	62	96	81	N
Green coconut (<i>Cocos nucifera</i>)	All year (L)	96	97	92	N
Kavika (<i>Syzygium jambos</i>)	Jan (L)	93	86	89	N
Pear (<i>Pyrus communis</i>)	All year (I)	64	95	86	N
Soursop (<i>Annona muricata</i>)	Nov-Jan (L)	78	73	75	N
Starfruit (<i>Averrhoa carambola</i>)	Jan-Mar (L)	40	78	56	N
Wi (<i>Spondias dulcis</i>)	Jun-Aug (L)	87	62	78	N

Data sources: 2004 NNS, consultation with NFNC, and Thaman (1990)

*Local (L) and import (I)

2.7 Conclusion

This chapter provided background information on Fiji and the food and nutrition situation to provide context for the research. Historical influences, particularly colonial policies which have shaped modern politics, land tenure, and agriculture, were highlighted. Population trends of increasingly poor quality diets and diet-related chronic disease were discussed also.

In the second half of this chapter, the most recent national evidence on FV availability and consumption in Fiji were reviewed. FV intake was identified to be suboptimal, with only 15% of the adult population achieving the recommended five servings per day (Ministry of Health, 2014). A range of FV products were found to be acceptable to consumers in all ethnic groups; however, the data is inadequate to conclude that insufficient supply contributes to low FV consumption.

Further evidence on FV supply and demand is needed to help policy-makers and stakeholders design policies and programmes to increase FV intake (Ministry of Health, 2010a; National FPAN Advisory Committee, 2010). In the next chapter, the literature on nutrition-oriented value chain analysis is reviewed to inform the development of a suitable research design to explore Fiji's FV supply and demand.

CHAPTER THREE: LITERATURE REVIEW: MAJOR TRADITIONS OF VALUE CHAIN RESEARCH AND NUTRITION-ORIENTED VALUE CHAINS

3.1 Introduction

This chapter critically reviews the background and development of nutrition-oriented value chain research. Due to the size of the relevant academic literature, the rate at which it continues to grow, and the ambiguity and overlap in the concepts and terminology used, this chapter does not endeavour to be an exhaustive review. Rather, it seeks to highlight the key aspects of the literature in order to inform the development of a suitable research design for a nutrition-oriented analysis of FV value chains.

The chapter is organised in six main sections. Section 3.2 presents and outlines the value chain concept and Section 3.3 situates analyses of value chains within a systems perspective. Section 3.4 reviews the major theoretical and methodological traditions of value chain research. Section 3.5 introduces the field of nutrition-oriented value chain research and reviews the published literature. Finally, Section 3.6 summarises how a strategic business management approach focused on uncovering the barriers and facilitators to a product's competitiveness offers the greatest potential for nutrition-oriented value chain research aimed at identifying the underlying influences on local FV availability, affordability, and acceptability.

3.2 Value chain concept

The term 'value chain' was coined in 1985 by Michael Porter in his book, *Competitive Advantage: Creating and Sustaining Superior Value* (Porter, 1985). Porter uses the term to refer to a series of activities that a firm or group of linked firms uses to add value to a product or

service. Central to this definition and subsequent conceptualisations are two core elements: chain and value.

The chain metaphor is meant to convey a set of interchangeable links (Walters & Rainbird, 2007b) that interact to supply goods and services to consumers, with a change in one part affecting the other parts. For a food product, this includes the various phases of on-farm production (including procurement of inputs), any processing or product transformation, delivery to the consumer, and final use or disposal as waste. As the product progresses through the chain and transactions take place between chain actors, “[m]oney changes hands, information is exchanged, and value is progressively added” (da Silva & de Souza Filho, 2007, p. 1). It is the explicit focus on the transformation of value that distinguishes a value chain from a standard supply chain. Attention is usually directed to the process of value addition; however, the maintenance or loss of value may be relevant to some chains, particularly those for food products.

In value chains, the final consumer is the source of value (Fearne et al., 2009; Feller, Shunk, & Callarman, 2006; Heikkilä, 2002; Porter, 1985). In the marketplace, consumer perceptions of value are transformed into demand for a product or service. This demand then flows from the consumer towards the primary producer, opposite the flow of supply. Accordingly, value in the chain is manifested differently for the different actors. For consumers, value is considered in the context of individual or collective utility, whereas for the other actors, value is measured in financial returns derived from the demand flow (Fearne et al., 2009). In an equitable, fully-integrated value chain, the financial compensation (or other incentives) for chain actors is proportionate to the value their activities add for consumers (Feller et al., 2006). Thus, successful and sustainable value chains provide value to both consumers and chain actors (Walters & Rainbird, 2008).

Value chains are principally concerned with creation or maintenance of value, typically through innovation in the chain and/or the development of demand (Jüttner, Christopher, & Baker, 2007; Jüttner, Godsell, & Christopher, 2006; Walters & Rainbird, 2008; Webber & Labaste, 2010). Innovation can create cost efficiencies and/or enhanced products and services, which translate into higher value or more competitive pricing. Marketing is also commonly employed in value chains to add value to the product or service for the consumer (Jüttner et al., 2007; Walters & Rainbird, 2008; Walters, 2006). The increase in demand that is developed through marketing results in an increased demand flow, generating greater levels of value for chain actors in the form of financial returns.

The term ‘value chain approach’ refers to the application of the value chain concept. As detailed in the following sections, there is no one value chain approach, as the concept has a range of research and practice applications.

3.3 Value chains as systems

Value chains are often referred to as systems (e.g. Fearne, Garcia Martinez, & Dent, 2012; Gereffi, Humphrey, & Sturgeon, 2005). In its broadest sense, a system is a bounded entity or process comprised of two or more interrelated and interdependent components. Systems thinking serves as a “meta-theory for examining and understanding the behaviour of complex entities” (Walsh & Clegg, 2004, p. 334) such as the networks of actors and activities involved in a value chain.

Systems thinking grew out of general systems theory, first introduced by biologist Ludwig von Bertalanffy in the early 20th century (Laszlo & Krippner, 1998; von Bertalanffy, 1968). It is a general theory of ‘wholeness’ in science, which “focuses attention on the whole as well as on the complex interrelationships among the constituent parts” (Laszlo & Krippner, 1998, p. 54).

Although von Bertalanffy is credited with first introducing general systems theory in the field of

biology, systems thinking emerged and grew in multiple disciplines in the early 1950s. For example, economist Kenneth Boulding's seminal paper "General systems theory: The skeleton of science" appeared in the journal *Management Science* in 1956. In the paper, Boulding (1956) argued that a main benefit of general systems theory was that it enabled relevant communication between scientists from different disciplines, thereby providing an approach for integration of ideas across the natural and behavioral sciences.

The systems view of value chains considers each chain actor as embedded within a series of interdependent vertical and horizontal relations (da Silva & de Souza Filho, 2007; Webber & Labaste, 2010). This perspective acknowledges that an actor's operational success is linked to the performance of other actors and the broader social and environmental context (Humphrey, 2005) and recognises that narrowly examining specific actors, activities, or institutions in isolation limits the ability to understand the various factors influencing their performance. Further, the systems perspective proposes that because of the complex nature of the chain as a system, there are places in the chain where a small change can have important consequences on everything (Hawkes, 2009; Meadows, 1999). These places are known as leverage points. While leverage points may exist in obvious places in the chain, they often work in unobvious ways that only careful analysis of the system *as a whole* can identify. Because of their potential to influence the performance of the whole chain, leverage points are "points of power" (Meadows, 1999, p. 1).

Value chain analysis refers to the broad method of investigating the whole chain from a systems perspective to identify opportunities for leveraging it for improved performance. It is inherently inter-sectoral and requires the participation of a range of stakeholders. The approach looks across functional silos to assess how the chain operates as a single unit (Hawkes & Ruel, 2011; UNIDO, 2009). Although applied in different ways, at its core, value chain analysis is about understanding the underlying drivers, enablers, and barriers to particular behaviour (both value-adding and non-value-adding) in a chain.

3.4 Major traditions of value chain research

This section outlines the major theoretical and methodological discourses from which nutrition-oriented value chains research has developed. Value chains have been an organising feature for research in various disciplines for diverse purposes. Hawkes and Ruel (2011, p. 35) argue that “[t]he unity of the approach comes from the process of adopting value-chain concepts in diagnosis and implementation” and distinguish three major streams of value chain research: the *filière* concept (used to examine agri-food supply chains in francophone countries), the strategic business management perspective (used to identify opportunities for increasing a chain’s competitiveness), and the political economy perspective (used to examine the causes, nature, and consequences of global industrial and technological integration). Although largely distinct, each of these perspectives has benefited from the cross-fertilisation of ideas and this interaction of ideas has led to the adoption of the value chain concept amongst researchers and practitioners in other fields, e.g. international development community (poverty reduction perspective).

3.4.1 Filière research

The *filière* concept was developed in the 1960s by French agricultural economists interested in contract farming and vertical integration. These researchers drew from a multitude of theories and perspectives including systems analysis, industrial organisation, institutional economics, management science, Marxist economics, and neo-classical welfare analysis (Raikes, Friis Jensen, & Ponte, 2000) to study the economic processes in production-to-consumption chains in a structured way (Henderson, Dicken, Hess, Coe, & Wai-Chung Yeung, 2002). Soon after, the *filière* approach was applied to research on agri-food chains in the francophone developing world, where it fit well with French colonial and post-colonial agricultural policy focused on commodity export and helped inform agricultural decision-making (Raikes et al., 2000). A particular focus

of filière research is on how public policies, investments, and public institutions affect production systems and the smooth flow of commodities (Bockel & Tallec, 2005).

There is no single method underpinning filière analyses. Raikes et al. (2000) describe the filière approach as “a loosely-knit set of studies with the common characteristic that they use the filière (or chain) of activities and exchanges as a tool and to delimit the scope of their analyses” (p.13). The authors go on to differentiate three broad streams of research, which they term the empirical, quantitative, and anthropological traditions. The empirical tradition is principally concerned with mapping the agents, actors, and commodity flows within a filière to create a physical map of the system. This approach focuses on generating an understanding of the totality of actors and relations around a specific commodity. The quantitative tradition focuses on the measurement of commodity flows (inputs and outputs), prices, and value-added along the chain, and has been applied to study the competitiveness of commodity exports emanating from the former French colonies. Finally, the anthropological tradition is concerned with generating a rich understanding of markets and power dynamics (Raikes et al., 2000).

Initially, filière studies dealt with domestic production systems; however, this was extended to analyses of processing and international trade in the 1980s (Raikes et al., 2000). In more recent years, filière research has been influenced by transaction cost economics, regulation theory, and convention theory (Raikes et al., 2000). The tradition retains a strong French foundation and little filière research has been published in English.

3.4.2 Strategic business management perspective

Michael Porter’s (1985, 1990) conception of value chains sits within the strategic business management literature, under the general remit of Supply Chain Management (SCM). The concept was developed to support managers in identifying the value embodied within the various supply and support functions of their firms and deciding ways to enhance that value in the interests of attaining competitive advantage. SCM first emerged in the early 1980s as a technique

for managing the flow of products within a single company and increasing efficiency (Feller et al., 2006; Laseter & Oliver, 2003). Over time, the boundaries of SCM expanded to the inter-firm level and today SCM considers all activities and actors involved in delivering a product from raw material through to the consumer (Laseter & Oliver, 2003). Overall, the approach aims to systemically and strategically integrate and coordinate the activities and actors across the chain so as to improve the performance of the supply chain at delivering the product at minimum cost (Mentzer, Keebler, Nix, Smith, & Zacharia, 2001).

There is no unified underpinning theory of SCM. Rather, a plurality of existing theories from various fields have been used to explain specific aspects, implying that no one theory sufficiently covers the breadth of SCM (Burgess, Singh, & Koroglu, 2006; Halldorsson, Kotzab, Mikkola, & Skøtt-Larsen, 2007; Ketchen & Hult, 2007). Halldorsson et al. (2007) suggest that the combination of principal-agent theory, transaction cost economics, the resource-based view, and network theory is most useful to explain structure and management issues of supply chains (Table 2). These authors argue that, when considered together, the four theories can provide a mid-level theory for SCM, which they term the “new institutional economics perspective”, but caution that it is just one perspective and other theories and combinations should also be considered and drawn upon (Halldorsson et al., 2007).

SCM also draws from the concept of competitive advantage, as developed by Porter (1985).

Porter argues that to achieve and maintain competitiveness, firms or chains must offer consumers either lower prices or unique product or service attributes. He contends that this can be achieved through the adoption of a focused cost leadership or product differentiation strategy. Competitive advantage is inherently relative and the concept of economic rent underpins the competitive process. Economic rent refers to the difference between the amount of money a firm or chain must obtain to operate and the surplus returns it receives in excess of that amount. It is the

pursuit of rent that fuels the competitive process and drives innovation across chains (Kaplinsky, 1998).

Table 2. Four key theories to SCM

Theory	Area of support	Description	Sources
Principal-agent theory (PAT)	Supportive of questions regarding supply chain organisation	PAT concerns the use of contracts to motivate one party (the ‘agent’) to act in the interest of another (the ‘principal’). The theory focuses on determining the most efficient contract to govern the relationship using a mix of behavioural and outcome-based incentives, given assumptions of self-interest, risk aversion, asymmetric information, and goal incongruence.	(Eisenhardt, 1989a; Hornibrook, 2007)
Transaction cost economics (TCE)		Transaction costs are expenditures associated with engaging in a commercial exchange (e.g. money, time, resources). TCE focuses on the organisation of transactions on a spectrum between spot markets and vertical integration and offers an explanation for why chains configure as they do. TCE characterises the costs involved in transactions according to three variables – uncertainty, frequency, and asset specificity (i.e. relationship-specific variables that tend to lock firms into their relationships) – and contends that firms adopt governance mechanisms in an attempt to minimise the costs associated with a transaction.	(Williamson, 1975, 1991)
Resource-based view (RBV)	Supportive of questions regarding management of the chain	RBV concerns competitive advantages related to a firm’s possession of different types of resources and capabilities that are difficult to replicate. Supply chain relationships serve as a means to access resources and competencies outside of the firm and can be important hard-to-imitate assets or resources in their own right.	(Barney, 2001; Peteraf, 1993)
Network theory (NT)		NT is concerned with how dyadic relationships between firms are embedded in broader networks of relationships. It suggests that organisational behaviour is conditioned by a firm’s interaction with other firms in its network and that a benefit can be gained from the strategic formation of ties with other parties with complementary capabilities.	(Håkansson & Persson, 2004; Omta, Trienekens, & Beers, 2001)

Source: Author’s own, based on Halldorsson et al. (2007)

From its initial introduction, SCM's profile quickly grew as companies placed great emphasis on increasing efficiency (Jüttner et al., 2007; Lummus & Vokurka, 1999; Mentzer et al., 2001).

Drivers for SCM's boom in popularity included the rise in national and international sourcing and competition, the decline in vertical integration, and the growing emphasis on time- and quality-based competition (Lummus & Vokurka, 1999; Mentzer et al., 2001). These developments, in combination with profound shifts in social, demographic, economic, and technological trends, contributed to increased market uncertainty (Gooch, 2005; Henson, 2006; Mentzer et al., 2001; Slater, 1997). This uncertainty, in turn, necessitated faster and more detailed information exchange between trading partners and greater flexibility across the chain (Mentzer et al., 2001).

With the growing importance of close relationships, cost containment provided an obvious platform for collaboration. Large food companies (e.g. manufacturers and retailers) widely adopted SCM principles, through the adoption of barcode scanning and development of the 'Efficient Consumer Response' (ECR) tool, which aims to reduce transactions costs, improve operational efficiency in the supply chain, and better manage demand (Hawkes, 2008; Stewart & Martinez, 2002). However, as the marketplace continued to evolve, with consumers expressing greater preference for differentiation of products and services rather than simply cost and availability, SCM's focus on efficiency and cost containment was no longer sufficient (Godsell, Harrison, Emberson, & Storey, 2006; Jüttner et al., 2007, 2006; Walters & Rainbird, 2008). A primary critique was that its narrow focus on efficiency did not help firms or chains discover what consumers perceive as valuable and translate that into consumer value propositions (Jüttner et al., 2007; Walters, 2006).

The introduction of lean management helped shift the focus of the field to consider not only how the supply process could be optimised but also how consumer value could be maximised. The lean approach has its origins in the automotive industry, where it is credited with advancing Toyota to a leading international automaker (Womack, Jones, & Roos, 1990; Womack & Jones,

1996). This management technique has five major principles, first detailed by James Womack and Daniel Jones (1996) in their well-known book, *Lean Thinking: Banish Waste and Create Wealth in Your Organization*: (1) specify value from the standpoint of the consumer; (2) identify all activities essential to produce the product or service and eliminate steps that do not create value; (3) optimise the flow of value-adding steps; (4) make only what is ‘pulled’ (i.e. ordered) by the next upstream customer; and (5) continuously reassess activities and remove wasteful steps. Although lean principles originated outside the agri-food sector, they have been applied successfully to the supply chains for a range of packaged food products (King & Venturini, 2005).

As SCM continued to evolve with the introduction of more demand-led approaches, ‘value chain thinking’ emerged as a distinct offshoot. Advocates of value chain thinking argue that SCM is fundamentally underpinned by a ‘push’ philosophy and is incompatible with the consumer-centric focus of ‘pull’ systems characteristic of value chains. Value chain management (VCM) was presented as an alternative, and according to Bonney et al. (2007) is distinguished from SCM by a strategic orientation wholly focused on consumer value. (The term ‘demand chain management’ has also been offered by some scholars (e.g. Heikkilä, 2002; Jüttner et al., 2007, 2006; Walters & Rainbird, 2004, 2008; Walters, 2006) but has not been favoured among those who study agri-food chains.) Gooch (2005) identified two stages in VCM: identifying consumer demands and aligning operations to meet those demands.

Demand-led approaches such as VCM fit well with the customer value-based theory of the firm (Jüttner et al., 2007; Slater, 1997). This theory asserts that “superior performance accrues to firms that have a customer value-based organizational culture (i.e., a market orientation), complemented by being skilled at learning about customers and their changing needs and at managing the innovation process, and that organize themselves around customer value delivery processes” (Slater, 1997, p. 164). Firms with a customer-value orientation therefore display three

major characteristics: (1) a continuous cycle of learning about customers; (2) a commitment to innovating, taking risks, and learning from experiences; and (3) processes directed towards the creation of value for customers (Slater, 1997). For these firms, knowledge of customer needs and preferences forms the basis for decision-making on what to produce, how much to produce, and how to market it (Kohli & Jaworski, 1990). In turn, chains which adopt a market orientation will display the same characteristics, except they will be organised around the generation of value for consumers (i.e. the final users of the finished product), as well as the satisfaction of the needs of customers (i.e. the next link in the chain) (Fearne et al., 2012; Grunert et al., 2005).

A major contribution of value chain thinking is the balancing of efficiency (i.e. cost minimisation in the chain) with effectiveness (i.e. customer satisfaction) (Heikkilä, 2002; Soosay, Fearne, & Dent, 2012; Walters, 2006; Zokaei & Simons, 2006). The cost minimisation emphasis of SCM is not eliminated, but instead transformed to one of cost optimisation. The scope of what consumers perceive as valuable is identified and the role of chain actors is to work together to determine, within that scope, what is feasible and then align their activities accordingly to increase that value in the products or services created (Walters & Rainbird, 2008).

A second important (and related) contribution is the identification and removal of wasteful activities. Monden (1993) distinguished three types of activities in value chains: non-value adding, necessary but non-value adding, and value-adding. Non-value adding activities are those that are purely wasteful and should be removed to increase efficiency in the chain and allow resources to be focused on value-adding activities (thereby increasing effectiveness). Necessary but non-value adding activities are those that, although not contributing directly to consumer value, act not to decrease value and are essential to maintain under current operating procedures. Value-adding activities are those that increase consumer value.

Value chain analysis is central to VCM and within strategic business management is a multidimensional diagnostic approach for assessing the current performance of a chain and envisioning an improved future state. It focuses on the flows of materials, information, and finance through the chain and provides a mechanism for identifying bottlenecks and detecting untapped opportunities for the generation of consumer value. It has its origins in the value stream mapping tool (Hines & Rich, 1997; Rother & Shook, 1998; Womack & Jones, 2002), created in the context of lean manufacturing. Value stream mapping focuses on mapping material and information flows within and between firms and identifying wasteful activities. As with value stream mapping, value chain analysis is concerned with material and information flows and waste elimination, but contains an additional focus on inter-firm relationships (Bonney et al., 2007; Fearn et al., 2012; Soosay et al., 2012; Taylor, 2005). According to Fearn et al. (2012), a further distinction between the two approaches is the expanded line of sight of value chain analysis; while the primary focus of value stream analysis is the manufacturing process, value chain analysis also considers the contribution of input suppliers and service providers to the addition of value and generation of waste.

Prior to beginning a value chain analysis, it is necessary to select the value stream to be analysed (Taylor, 2005; Womack & Jones, 2002). A value stream is “a specific product or product family serving a specific customer or market segment” (Taylor, 2005, p. 748). The aim of choosing a value stream is to focus the work and minimise the complexity of the study. It involves defining the scope of the study and choosing the particular pathway and product of interest (Taylor, 2005).

Following stream selection, the basic strategic business management approach to value chain analysis starts with market research to characterise consumer value and then includes mapping the activities in the chain, engaging in direct observations, and speaking with chain participants to better understand how they interact with one another and exchange products and information. In

the latter steps, after the nature of consumer value has been established, three core issues are explored (Bonney et al., 2007; Fearne et al., 2012; Soosay et al., 2012; Taylor, 2005):

- The dynamics of the *material flow* and the creation of value through the chain – which activities add value for consumers and are those activities the focus of chain investment?
- The dynamics of the *information flow* – how transparent is the flow of information in the chain and to what extent are chain actors' decisions influenced by what consumers value?
- The nature of *relationships* – how much trust and commitment exists between chain actors and how is the chain governed?

Investigation of these issues begins with the generation of a graphical representation (process map) of the material flows, information flows, and relationships within and between businesses. Often, the first version of the map is created in collaboration with actors in the chain – either by ‘walking the chain’ together (Bonney et al., 2007; Rother & Shook, 1998; Soosay et al., 2012; Taylor, 2005; Womack & Jones, 2002) or in a workshop-style session (Simons, Francis, Bourlakis, & Fearne, 2003) – and then validated and expanded through observations and key informant interviews. Activities are described and categorised as value-adding, necessary but non-value-adding, or unnecessary from the perspective of the consumer, and the quality of information flows and relationships is determined. Where available and appropriate, company reports, tables, and charts may also be reviewed. The process is iterative, with activities and issues identified as critical or problematic being followed up in subsequent data collection. For example, in an Australian case study of bagged salad, researchers used a combination of ‘walking the chain’, interviewing key informants in each business, and holding feedback sessions with senior management of the farm to gather and validate findings (Bonney et al., 2007).

The data collected in the consumer research, mapping, and fieldwork stages are analysed to uncover the chain's strengths and weaknesses (Bonney et al., 2007; Soosay et al., 2012; Taylor,

2005). This information is, in turn, used to formulate recommendations for improvement projects across the chain. The emphasis of these recommendations is on opportunities for co-innovation (innovation between two firms or actors) (Bonney et al., 2007; Walters & Rainbird, 2007a), “as these are notoriously difficult to achieve and, as a result, can deliver benefits that are difficult for other value chains to replicate, providing a potential source of sustainable competitive advantage” (Fearne et al., 2009, p. 10). As a final step in the value chain analysis, the findings are compiled along with the recommendations and presented to participating firms who are ultimately responsible for collaborating to define and implement improvement strategies (Bonney et al., 2007; Simons et al., 2003; Taylor, 2005).

Although initially developed in the context of industrial manufacturing, value chain analysis has been applied to several of agri-food case studies in recent years (Table 3). Most of these studies have been based in developed countries, but a few developing country case studies have been carried out, including work in Kenya (Macharia, Collins, & Sun, 2013), Nepal (Adhikari, Collins, & Sun, 2012), and Papua New Guinea (Bonney, Collins, Miles, & Verreynne, 2013). The agri-food sector presents particular challenges to value chain analysis as the supply base is often fragmented, weak transactional relationships remain the norm (Simons et al., 2003), and long product lead times inhibit the application of lean concepts such as ‘pull’ (Taylor, 2005).

Table 3. Examples of agri-food value chain analysis case studies from the strategic business management perspective

Paper	Focus	Case study site	Unit of analysis
Dekker (2003)	Use of a cost model by a large supermarket and its suppliers	UK	Interfirm relationship between supermarket and suppliers
Simons et al. (2003)	Sheep meat products	UK	Chain linking a primary producer of sheep, a meat processor, and a supermarket
Taylor (2005)	Fresh pork products	UK	Chain linking a farming company that controlled approximately 400 pig farms, a meat processor, and a supermarket group
Grunert et al. (2005)	New Zealand lamb; Brazilian orange juice; Norwegian frozen cod; Danish bacon	New Zealand and Brazil to the EU; Norway and Denmark to the UK	Chains linking primary producers to final consumers
Zokaei and Simons (2006)	Fresh pork products	UK	Chain linking one medium-sized farmer, a processor (abattoir and butcher), a distribution centre, and a public sector eatery
Bonney et al. (2007)	Bagged salad	Australia	Chain linking farm producer of bagged salad and the retail outlets they supply
Seth et al. (2008)	Edible cottonseed oil	India	Chain of activities and actors involved in oilseed processing
Soosay et al. (2012)	Wine	Australia to UK	Chain connecting grape growers in South Australia to one particular wine producer and then to shoppers at a specific UK supermarket
Adhikari et al. (2012)	Tomato	Nepal	Local tomato chains supplying Kathmandu consumers
Macharia et al. (2013)	Kale/spinach	Kenya	Kale/spinach chains originating in the peri-urban areas and supplying Nairobi consumers
Bonney et al. (2013)	Vegetables	Papau New Guinea	Various chains supplying Port Mosby consumers
Bonney et al. (2013)	Plums	Vietnam	Chains originating in Vietnam's northwest highlands and supply domestic and export markets

Source: Author's own

3.4.3 Political economy perspective

The third major precursor to nutrition-oriented value chains research comes from the political economy perspective and is concerned with examining the causes, nature, and consequences of global industrial and technological integration. This line of research – known collectively as ‘global chains’ research – has its foundation in Wallerstein’s world-systems analysis, which focuses on the world-system as the unit of social analysis and is concerned with understanding the differential implications of the capitalist world economy (Wallerstein, 2004). Thus, the sharing of power and benefits among developed and developing country participants is a central theme. Although the global chains literature is both broad and multidisciplinary, three key analytical frameworks can be distinguished: Global Commodity Chains, Global Value Chains, and Global Production Networks (Coe, Dicken, & Hess, 2008b).

In 1994, the concept of Global Commodity Chains (GCC) was introduced by Gary Gereffi and Miguel Korzeniewicz to provide a framework for understanding globally integrated production systems and a means for incorporating analyses of them into the study of economic development (Gereffi & Korzeniewicz, 1994). Gereffi initially described GCCs as having three key dimensions: an input-output structure, a specific geographical scope, and a governance structure (Gereffi, 1994). Later he added institutional context as a fourth dimension (Gereffi & Fernandez-Stark, 2011). Research on GCCs has primarily emphasised the governance structure of the chain and the role of so-called ‘lead firms’ in organising activities in the chain and establishing global production and distribution networks. Gereffi (1994) defined governance as the “authority and power relationships that determine how financial, material, and human resources are allocated and flow within a chain” (p. 97) and distinguished two broad governance structures: producer-driven (i.e. manufacturers are the key agents) and buyer-driven (i.e. international brand name companies and retailing firms are the key agents).

After several years of study, researchers found that the GCC framework did not adequately specify the range of network forms that were being uncovered and the use of the term ‘commodity’ failed to acknowledge that the chains were relevant to both differentiated and undifferentiated products (Gereffi, Humphrey, Kaplinsky, & Sturgeon, 2001; Gereffi et al., 2005; Kaplinsky & Morris, 2000). Further, GCC was not the only chain-based approach for studying economic globalisation and various terms were being used to discuss similar ideas (Gereffi et al., 2001). Following an international workshop to review various global chains approaches in September 2000, the Global Value Chain (GVC) concept was proposed (Gereffi et al., 2001). In addition to the strong influence of the GCC framework, the GVC concept was shaped by the strategic business management literature, as acknowledged by participants at the workshop: “For us, the starting point for understanding the changing nature of international trade and industrial organization is contained in the notion of a value-added chain, as developed by international business scholars who have focused on the strategies of both firms and countries in the global economy” (Gereffi et al., 2005, p. 79). The GVC is also distinguished from its predecessor GCC by a more marked interest in the policy implications of chain research (Bair, 2005). In particular, global chains research asks “questions about the winners and losers in the globalisation process, how and why the gains from globalisation are spread, and how the number of gainers can be increased” (Gereffi et al., 2001, p. 1).

As with the GCC tradition, governance is a central concept in the GVC literature. Debates concerning the strength of the producer-driven vs. buyer-driven dichotomy led to the elaboration and re-definition of governance in GVCs (Bolwig, Ponte, du Toit, Riisgaard, & Halberg, 2008; Gereffi et al., 2005; Sturgeon, 2008). Drawing on three streams of literature – transaction costs economics, production networks, and technological capacity – Gereffi et al. (2005) developed a GVC theory of governance, based on a matrix of three independent variables that can each be categorised as high or low. These variables are: the complexity of information that must be

transferred between chain actors; the extent to which this information can be codified; and the competence of suppliers. The matrix yields eight possible combinations, of which three are determined to be highly unlikely. This leaves five distinct governance structures: market (i.e. arms-length exchanges), modular (i.e. transactions which are relatively easy to codify), relational (i.e. exchanges that involve complex information, mutual dependency, and high levels of asset specificity), captive (i.e. relationships in which there is a high degree of power asymmetry between small suppliers and much larger buyers), and hierarchy (i.e. vertical integration) (Gereffi et al., 2005).

Upgrading is another important concept in the GVC literature and considered complementary to governance. Gereffi and Fernandez-Stark (2011) argue that while governance takes a ‘top down’ view of GVCs, focusing on lead firms and industrial organisation, upgrading holds a ‘bottom up’ perspective, focusing on strategies used by firms, countries, or regions to improve their positions in the global economy. Early work on upgrading in GVCs suggested that, as a consequence of ‘learning by exporting’ and ‘organisational succession’, there was a typical trajectory in which firms moved from basic assembly activities to the provision of ‘full-package supply’ (Gereffi, 1999; Humphrey & Schmitz, 2002; Humphrey, 2004). More recent research has argued that upgrading is less straightforward and that there is potential for power asymmetry in the chain to inhibit upgrading by limiting knowledge and information flows (Bair, 2005; Humphrey & Schmitz, 2002). Building on Gereffi et al. (2001), Humphrey and Schmitz (2002) distinguished four strategies for upgrading: (1) transform inputs into outputs more efficiently (process upgrading); (2) move into more sophisticated product lines (product upgrading); (3) acquire new functions (or abandon existing functions) to increase the overall skill content of activities (functional upgrading); and (4) move into new productive activities (inter-chain or inter-sectoral upgrading).

A third global chains framework – Global Production Networks (GPN) – was developed in the early 2000s by economic geographers at the University of Manchester and their collaborators in a deliberate attempt to broaden the scope of GCC and GVC approaches (Henderson et al., 2002). In particular, GPN thinkers argue that the GCC and GVC frameworks are impaired by their narrow focus on the firms and transactional relationships within the value chain, which leads to exclusion of other actors and relationships which may be involved but lie outside the chain. Thus, the GPN approach takes the broad network as the unit of analysis and attempts to consider all relevant sets of actors and relationships (Coe, Dicken, & Hess, 2008a).

GPN analyses focus on three conceptual categories (value, power, and embeddedness) and are considered through four dimensions (firms, institutions, networks, and sectors). The treatment of embeddedness within the GPN framework is an important diversion from the GCC and GVC approaches. Embeddedness refers to the ways in which firms are grounded within specific locations, societies, and networks (Henderson et al., 2002). This feature of the framework conveys the important influence of the specific socio-political, institutional, and cultural context in which each network is anchored (Coe et al., 2008a). Despite the distinctions, Levy (2008) argues that most research based on the GPN framework to date has been very similar to that based on the GCC framework and that, like GVC, the GCC and GPN literatures have “an increasingly developmental tone” (p. 18) discussing upgrading opportunities for developing country firms.

Of the three major global chains frameworks, the GVC approach dominates the literature, particularly the literature pertaining to the agri-food sector. Agriculture – and the horticulture export industry in particular – has been a focus of several global chains scholars. Motivated by growing global demand for fresh FV, many developing countries have actively pursued horticultural production and export and together have successfully captured a large portion of the global FV market (Shah, 2008). GVC scholars have examined the transformation of this

industry, with particular attention to the consequences and implications of developed country standards for workers and suppliers in developing countries (Dolan & Humphrey, 2000; Fernandez-Stark, Bamber, & Gereffi, 2011).

GVC research typically employs qualitative case studies of transnational networks of companies. Interview-based field research and secondary analysis of industry and government data are common.

3.4.4 Poverty reduction perspective

In the 2000s, the value chain concept emerged in the development literature as an organising feature for efforts to promote pro-poor growth and poverty reduction through income generation. This application is sometimes called ‘value chain promotion’ or the ‘value chain approach to development’ and integrates elements from both the strategic business management and global chains literatures. The focus is on identifying opportunities to enhance the financial returns to disadvantaged chain actors and then implementing policies and programmes in line with the findings. In recent years there has been a concerted effort to incorporate more social and environmental dimensions (Bolwig, Ponte, du Toit, Riisgaard, & Halberg, 2010; Gereffi & Fernandez-Stark, 2011; Riisgaard et al., 2010). Given the important role of agriculture for the world’s poor, as a source of both nutrition and income, agri-food value chains have been at the centre of this work.

Many major international development departments, agencies, and institutions now have incorporated value chain approaches into their efforts. Today, a large number of manuals, guidelines and toolkits for value chain promotion exist (Table 4). Although each contains a slightly different focus, they typically involve four broad components: (1) prioritising chains and choosing one or multiple for promotion; (2) analysing the chain and developing an upgrading or enhancement strategy in line with findings; (3) implementing the strategy; and (4) monitoring the

impact. Most efforts for value chain promotion contain a strong participatory component, with an aim to build not only local engagement in the projects, but also capacity.

Table 4. Examples of training and support materials for value chain promotion

Guideline or toolkit	Source	Components
Training curriculum: Facilitating value chain development (MicroLinks, n.d.)	US Agency for International Development (USAID)	Four modules available online: (1) understanding the value chain system; (2) understanding system dynamics (i.e. analysis); (3) envisioning the future of a system (strategy development and project planning); and (4) managing a value chain system project
Making value chains work better for the poor: A toolbox for practitioners of value chain analysis (Van den Berg et al., 2004)	Asian Development Bank (ADB)	Eight “tools” for planning and executing a value chain analysis: (1) prioritising value chains for analysis; (2) mapping the value chain; (3) costs and margin; (4) analysing technology, knowledge, and upgrading; (5) analysing incomes in the value chain; (6) analysing employment in the value chain; (7) governance and services; and (8) linkages.
ValueLinks manual: The methodology of value chain promotion (GTZ, 2007)	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)	Twelve modules divided in four broad sections: (1) setting project boundaries; (2) chain analysis and strategy; (3) implementation; and (4) monitoring.
A handbook for value chain research (Kaplinsky & Morris, 2000)	International Development Research Centre (IDRC)	A range of methods to address nine aspects of value chains: (1) identifying a point of entry for the analysis; (2) mapping; (3) evaluating product segments and critical success factors; (4) analysing how producers access final markets; (5) benchmarking production efficiency; (6) understanding governance; (7) understanding upgrading opportunities; and (8) exploring distributional issues.
Agro-value chain analysis and development (UNIDO, 2009)	United Nations Industrial Development Organization (UNIDO)	Seven aspects of the UNIDO method: (1) selection and prioritisation of chains; (2) mapping the chain; (3) analysing technical capabilities; (4) analysing economic performance and benchmarking competitiveness; (5) formulating an upgrading strategy for selected chains; (6) implementing the strategies; and (7) monitoring and impact assessment.
Building competitiveness in Africa’s agriculture: A guide to value chain concepts and applications (Webber & Labaste, 2010)	The World Bank	Thirteen “tools”: (1) choosing priority sectors for interventions; (2) designing informed strategies; (3) conducting benchmarking and gap assessments; (4) upgrading and deepening; (5) identifying business models for replication; (6) capturing value through forward and backward integration; (7) horizontal collaboration; (8) positioning products and chains for greater value and competitiveness; (9) applying standards and certifications to achieve greater quality; (10) identifying needed support services; (11) improving the operating environment by promoting public-private dialogue; (12) achieving synergies through clustering; and (13) monitoring achievements in performance.
Value chain analysis for policy-makers and practitioners (Schmitz, 2005)	International Labour Organization (ILO)	Outlines how a value chain approach can be used to address a range of policy problems related to enterprise development and local economic development.

Source: Author’s own

3.5 Nutrition-oriented value chain research

This section reviews the published literature on nutrition-oriented value chains. The concept was first articulated by Hawkes and Ruel (2011) in their report “Value chains for nutrition” for the International Food Policy Research Institute’s (IFPRI) landmark 2011 conference ‘Leveraging Agriculture for Improving Nutrition and Health’. Since, value chains have been embraced by the international public health nutrition community and are promoted by several major organisations, including IFPRI and the broader CGIAR Consortium (IFPRI, 2011). At its core, nutrition-oriented value chains research is concerned with understanding how food value chains are organised, why they are structured and function as they do, and how they can be levered for improved nutrition outcomes (Hawkes & Ruel, 2011). A related, but distinct line of inquiry focuses on food safety and health, with particular attention to microbial hazards, chemical contaminants, and occupational health risks which emerge along food value chains (Chenevix Trench, Narrod, Roy, & Tiongco, 2012; Taylor & Hinrichs, 2012), but this is not covered in this review or thesis.

Hawkes and Ruel (2011) argue that the characteristics of food value chains have important implications for food availability, affordability, acceptability, and nutritional quality and therefore merit consideration from the nutrition community (Figure 4). They suggest that the application of a value chain framework can support the attainment of two major nutrition goals: increasing the year-round availability of affordable nutritious foods and increasing demand for nutritious foods. Value chain analysis can be used to investigate why nutritious foods are inaccessible to specific populations and determine how the chain could be leveraged to improve availability and affordability, reduce nutrient losses, or enhance nutritional content. Further, the approach can be used to uncover the consumer definition of value and determine the scope of things consumers are willing to accept. This information can then be used to boost the desirability of nutritious foods through altering the value consumers attribute to the foods or increasing the acceptability of

the products (e.g. enhancing product appearance) through action in the chain (Hawkes & Ruel, 2011).

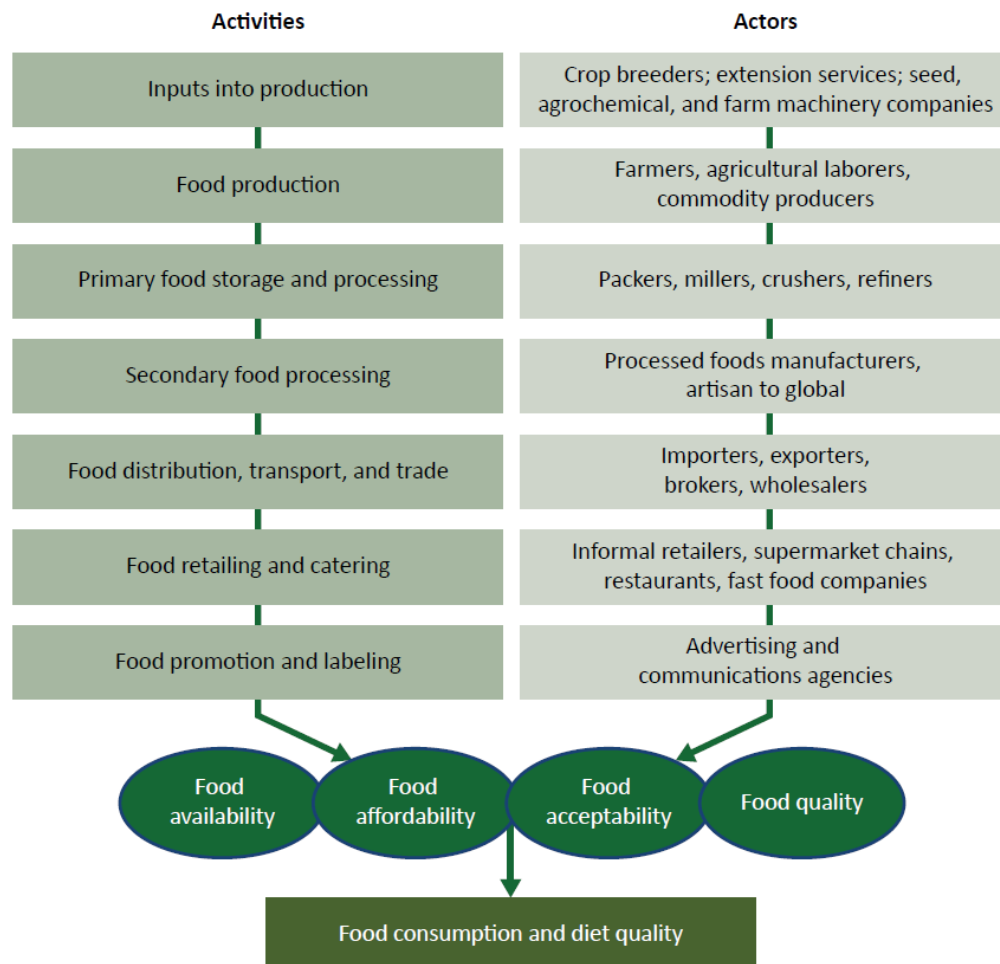


Figure 4. Basic linkages between food supply chains, consumption, and diet quality
Source: Hawkes and Ruel (2011, p. 4)

To be sustainable, nutrition-oriented value chain approaches must support the economic well-being of chain actors (Hawkes & Ruel, 2011). Although Figure 4 depicts a uni-directional relationship between food supply chains and consumption, food choices also have important implications for the organisational structure of the food industry, with actors responding to the perceived demands of consumers (Mentzer Morrison, 2002; Nugent, 2004). For example, in the words of Dawson (1995, p. 77), food retailers are “both reactive and proactive agents in the

process of consumer choice”. Different sectors of the agri-food system compete for the consumer dollar and demand for nutritious foods must be met or created to make production economically attractive to farmers, processors, retailers, and other participants in the chain.

Hawkes et al. (2013) distinguish between two types of agri-food value chains relevant for consideration: ‘short’ and ‘long’ chains. Short chains are those present in areas where markets are served by local farmers, such as island communities, urban agriculture, and farm-to-school programmes, and also describe subsistence production. In short chains, changes to production have a direct impact on what is available for consumption. In contrast, long chains are those in which farmers and consumers have a more distant connection, such as chains characterised by cross-border trade or large-scale manufacturing. Long chains tend to be designed to increase efficiency at scale, making upstream interventions potentially very important (Hawkes, Thow, et al., 2013). The next two sub-sections provide an overview of the existing published literature.

3.5.1 Nutrition-oriented value chain research on short chains

The idea of leveraging short chains for healthy eating is not new, although in the past, research and intervention efforts rarely were developed or described with explicit value chain concepts. Efforts normally incorporate intervention in the chain and some sort of behaviour change communication, with an aim to improve both the supply of and demand for nutrient-rich foods (Hawkes & Ruel, 2011; Hawkes, Thow, et al., 2013; IFPRI, 2011). Short chain initiatives often emphasise linkages between sustainable development, income generation, nutrition, health, and culture, and tend to be ‘food based’ in that they “promote the consumption of foods that are naturally rich in micronutrients or are enriched through fortification” (Thompson & Amoroso, 2010, p. xii).

Interest in and use of nutrition-oriented value chain analysis to examine short chains and inform intervention activities has increased since the publication of the Hawkes and Ruel (2011) report.

This work is primarily concerned with chains supplying nutrient-rich foods to poor and marginalised populations characterised by food insecurity, undernutrition, or micronutrient deficiencies. In 2011, the CGIAR Consortium established nutrition-oriented and nutrition-sensitive value chains as a core research focus and outlined five specific objectives: (1) characterise the dietary patterns of target populations and identify available nutrient-rich foods; (2) understand the major constraints to consumption of nutrient-rich foods, including information gaps; (3) develop, test, and evaluate new tools to increase knowledge and awareness of nutrition amongst consumers and chain actors; (4) identify points in the chain where nutritional value is added or lost and test new models to enhance or preserve nutrition; and (5) evaluate impact and cost effectiveness of new tools and models. Similar to the strategic business management perspective, the starting point is to understand consumer wants and needs. The primary goal of this work is to stimulate demand for and increase access to nutritious foods for the poor, instead of the typical focus of value chain approaches to development on enhancing producer income (IFPRI, 2011). A variety of qualitative and quantitative methods are considered appropriate and necessary to carry out the research, including dietary intake surveys, market surveys, qualitative research with consumers and producers (e.g. interviews, focus group discussions, observations, shadowing, and focused ethnographic studies), and laboratory analyses of nutritional content (IFPRI, 2011). In recent years some short chain nutrition-oriented value chain research projects have been carried out (e.g. Anim-Somuah, Henson, Humphrey, & Robinson, 2013; Masters, Ghosh, Daniels, & Sarpong, 2013; Robinson, Nwuneli, Henson, & Humphrey, 2014), however the consumer research aspect tends to be marginalised.

Bonney et al. (2013) argue that the strategic business management approach to value chain research and development can and should be used to address nutrition problems. There is growing interest within strategic management in looking beyond internal costs and benefits to thinking more broadly about societal objectives, such as improving nutrition and health and

reducing poverty and environmental damage (Fearne et al., 2012; Porter & Kramer, 2011).

Bonney et al. (2013) propose re-framing food insecurity and undernutrition as entrepreneurial opportunities for the agri-food systems of the countries in which they persist. To illustrate the application of the approach for this purpose, the authors present a value chain research and development case study of fresh vegetable value chains serving Papua New Guinea's capital, Port Moresby. The analysis incorporated research activities to understand what consumers value and to map the material flows, information flows, and relationships in the chain. The findings were immediately used to support the design and development of intervention activities to improve vegetable production and reduce challenges and constraints in the marketing system, with early signs of success (Bonney, Collins, et al., 2013).

3.5.2 Nutrition-oriented value chain research on long chains

To date, the small body of literature on nutrition-oriented value chain research on long chains appears to focus on prevention of obesity and diet-related NCDs. Gereffi and Christian (2007) made perhaps the first substantive contribution to this literature when they presented a GVC approach to the study of childhood obesity at the WHO Early-Stage Expert Meeting on Trade and Healthy Diets. The GVC approach taken to the investigation of childhood obesity explores the role of large transnational corporations in determining where food comes from and how it is produced, marketed, and made available. In particular it seeks out upstream leverage points where intervention could bring large change for the chain and consumers (Gereffi, Lee, & Christian, 2009).

Following the initial introduction of their idea, Gereffi and colleagues have gone on to outline further and apply their approach in subsequent publications showcasing a range of case studies (Christian & Gereffi, 2010; Gereffi & Christian, 2010; Gereffi et al., 2009). Their work emphasises the role of transnational food manufacturing and fast-food companies – identified as lead firms – due to the significant power they command in the value chains and the potential they

hold for shaping diets. Recently, the GVC framework has been applied to a nutrition-oriented analysis of the Australian canned fruit industry (Hattersley, 2013). The findings of that study suggested a benefit to GVC analysis in identifying lead firms and the range of factors that underpin the structure and function of global food industries.

Acknowledging the work of Gereffi and colleagues, Hawkes (2009) developed a complementary approach (not based on GVC) for researching long chains and their implications for obesity and diet-related chronic disease, which she termed ‘consumption-oriented food supply chain analysis’. This approach progresses along five analytical steps to identify the structure of the chain and the major incentives and disincentives for chain actors. Briefly, the steps are: (1) describe the steps involved in the supply chain; (2) describe the organisational, financial, technological, and policy characteristics of the activities and actors at each step and the characteristics of consumers; (3) identify the organisational, financial, technological, and policy incentives and disincentives in the chain and how they interrelate with consumer incentives; (4) analyse how the features identified in steps two and three affect the food environment; and (5) determine how incentives in the chain could be leveraged to align better the food supply chain with healthy diets (Hawkes, 2009, p. 349)

To illustrate how the approach may be applied, Hawkes (2009) examined the supply of Coca-Cola beverages to vending machines in US schools. More recently, a consumption-oriented food supply chain analysis was employed to assess barriers and opportunities to increase the supply of FV locally and globally through the World Trade Organization’s Aid for Trade initiative (Thow & Priyadarshi, 2013) and to study the potential implications of a regulation on trans fat in India (Downs, Thow, Ghosh-Jerath, & Leeder, 2014). All examples revealed a number of opportunities for the use of policy to leverage long chains for healthy eating.

3.5.3 Summary of nutrition-oriented value chains research

Different analytical approaches suit different types of value chains and research questions.

Hawkes and Ruel (2011, pp. 35–38) have previously proposed nine unifying principles for nutrition-oriented value chain approaches (listed verbatim):

1. Start with explicit nutrition goals;
2. Clearly define the nutrition problem;
3. Create and capture value for nutrition;
4. Be expansive in the search for solutions, but tailor to context;
5. Focus on the functioning and coordination of the whole chain in order to create sustainable solutions;
6. Add value not only for nutrition (and consumers), but also for other chain actors;
7. Take a broader view of adding value for producers and consumers;
8. Focus on meeting, growing, and creating demand; and
9. Create a policy environment in which better nutrition is valued.

To summarise, the new field of nutrition-oriented value chain approaches holds potential to identify intervention opportunities within agri-food supply chains to improve nutrition. However, the evidence base remains small and, particularly for long chains, restricted to a few academics working in the field.

3.6 Conclusion

Of the major value chain traditions reviewed in this chapter (the *filière* concept, the strategic business management perspective, and the political economy perspective), the strategic business management perspective offers the most suitable orientation for nutrition-oriented value chain research to understand the underlying supply-side influences on fresh FV availability, affordability, and acceptability to consumers. The approach explicitly focuses on identifying

what consumers demand and why chains do or do not deliver that demand, making it the most supportive for solving nutrition problems in short chains. Whilst strategic business management studies have tended to focus narrowly on opportunities for financial gain for actors, the application of the approach to address broader societal challenges, such as health and poor nutrition, has been advocated (Bonney, Collins, et al., 2013; Fearne et al., 2012). In addition, recent work has demonstrated the applicability of the approach to the study of agri-food chains and diverse developing country settings. The next chapter builds on the review presented in this chapter in order to develop the research methods used in this thesis.

CHAPTER FOUR: METHODS

4.1 Introduction

This chapter describes the research design. It begins with a description of the theoretical and conceptual frameworks applied to the research (Section 4.2), followed by presentation of the methodological approach adopted (Section 4.3). Section 4.4 outlines the fieldwork site selection and study organisation in Fiji. Section 4.5 describes the research design and the methods used in the collection, analysis, and interpretation of the data. The chapter concludes with a summary of the fieldwork methods (Section 4.6).

This thesis aims to identify the strengths, limitations, and potential of nutrition-oriented value chain analysis to inform policy and programmes to increase fruit and vegetable intake in Fiji. To achieve this aim, the research had four specific objectives:

1. To review the major theoretical and methodological approaches which have influenced development of nutrition-oriented value chain analysis;
2. To identify what urban Fijian consumers value in FVs;
3. To map exemplar FV value chains, and identify the value chain activities and actors; and
4. To identify why the exemplar value chains are organised and function as they do, and how this contributes to product availability, affordability, and acceptability.

4.2 Theoretical and conceptual approach

This thesis draws on a range of theoretical and conceptual approaches and is underpinned by a critical realist perspective. Critical realism accepts the positivist supposition that reality exists independent of human conceptualisation; however, it asserts that reality can only be imperfectly understood because of the fallibility of human intellectual mechanisms (Sayer, 2000). Events are not pre-determined by laws of cause and effect before they occur, and research can be used to explain what causes events to happen or not happen. Critical realism argues that causal

explanation and interpretive understanding are interrelated in social science (Sayer, 2000). It offers a ‘natural fit’ for public health because it bridges the positivist biomedical model and the more constructivist social sciences, and its inclusive nature fits well with both the interdisciplinary aim of the research and the PhD candidate’s background in environmental studies, nutrition, and public health. Critical realism does not dictate a specific theoretical or methodological approach, thus this section outlines the theoretical and conceptual frameworks for the research.

The literature review (Chapter Three) suggested that there is no single theoretical framework applicable to nutrition-oriented value chain analysis, but that an integration of various frameworks is useful in examining the potential for food value chains to optimise the supply of and demand for nutritious foods. Nutrition-oriented value chain analysis is rooted in contemporary public health and thus driven by a motivation to improve diets for disease prevention and health promotion. Public health adopts an ecological perspective (Chapter One) which emphasises interactions between people and their environments and views behaviour as affecting and being affected by multiple levels of influence (Dahlgren & Whitehead, 2007; Glanz & Rimer, 2005; Lang & Rayner, 2012; Story et al., 2008). The study of food value chains as important contributors to diet and health is situated within the ecological perspective and agriculture and food systems appear in the Dahlgren and Whitehead (2007) model as a determinant of the social and material conditions in which people live and work.

The ecological perspective aligns well with the systems perspective outlined in Chapter Three, and systems approaches are widely accepted in contemporary public health. Building on the ecological perspective, systems frameworks, such as Glass and McAtee’s (2006) multi-level model of disease causation, are used to understand *how* the multiple levels of influence interact to determine health. Glass and McAtee’s (2006) model articulates how society, behaviour, and biology interact as part of a system to bring about a particular health status along two dimensions:

time and a nested hierarchy of structures. The model considers not only causal effects between biological and behavioural variables and changes in health, but also what the authors term ‘risk regulators’. Risk regulators are the social and environmental features that impose constraints and opportunities on behavioural risk factors (i.e. those things that differentially place people *at risk of risk* (Link & Phelan, 1995)). Borrowing Glass and McAtee’s (2006) terminology, food value chains are risk regulators; the actions taken in the chain influence nutritional quality, as well as food availability, affordability, and acceptability, which in turn shape or motivate consumption. The various elements of this thesis take an ecological perspective to public health and sit within the FV production-consumption system.

4.2.1 Theoretical approach

As detailed in Chapter Three, the common theoretical thread underlying value chain thinking within the strategic business management literature is a focus on competitive advantage and the application of lean principles, in which products are pulled through chains in response to demand and with minimal waste. The three major conceptual dimensions are material flows, information flows, and relationships (see Chapter Three). Briefly, material flows refer to the physical movement of products through the chain towards final consumers and the various activities involved therein. Efficient and effective material flows depend on supportive information flows, through which value chain actors obtain information on what consumers demand. This information can be used to inform what is created, processed, and delivered so as to optimise consumer value. Understanding the relationships between chain actors sheds light on how they organise and collaborate to manage uncertainties about the supply of materials and competencies necessary to develop competitive advantage.

Competitive advantage is ultimately determined by the choices of a value chain’s end-users – what they value dictates which competitive strategies will lead to success (Womack & Jones, 1996). The means-end chain model guided understanding of food choice in this study. A means-

end chain is one model to explain the cognitive process linking consumption of products to the achievement of desired end states (Gutman, 1982; Zeithaml, 1988). It proposes that consumers use a range of product attributes to infer quality and these quality perceptions in turn help satisfy consumption motives or values (Zeithaml, 1988). In the marketplace, consumers use product attributes to decide what product will provide the greatest value and hence what to buy. While the specific attributes that signal quality differ from product to product, higher level abstract dimensions can be generalised to groups of products (e.g. FV) (Zeithaml, 1988).

4.2.2 Conceptual framework

This thesis builds from the nutrition-oriented value chains concept first presented by Hawkes and Ruel (2011) and discussed in detail in Chapter Three. These authors identified four concepts central to the supply and demand of nutritious foods: availability, affordability, acceptability, and nutritional quality. As outlined in Chapter One, other concepts, such as household income and the decision-making power of women relative to men, also play a role determining consumption (Ruel et al., 2005), but these are considered outside the direct scope of value chain approaches and are therefore not addressed in this work.

Food availability refers to the presence of food in a specific location; if it is unavailable, it cannot contribute to nutrition or health. The literature on food affordability is dominated by research on food price elasticities. These elasticities are a measure of how a change in the price of a food is related to a change in consumption of that food and other dietary complements and substitutes. Food price is recognised as a key determinant of diet generally and FV intake specifically (see Chapter One); however, a full review of how prices affect consumption is outside the scope of this thesis and recently was undertaken by Green et al. (2013).

Food acceptability refers to consumers' subjective quality assessments of the food. The Total Food Quality Model (TFQM) (Grunert, Larsen, Madsen, & Baadsgaard, 1996) – which integrates the means-end model of consumer behaviour – was employed to guide inquiry around this

concept. The TFQM distinguishes between four dimensions of food quality: taste and appearance (hedonic characteristics), perceived healthfulness, process, and convenience. These dimensions are not independent, but overlapping and interrelated. According to the TFQM, consumers' underlying consumption motives or values will impact which quality dimensions are sought and the relative importance of each dimension will vary from consumer to consumer, as will perception and evaluation of different quality cues (Brunsø et al., 2002).

Nutritional quality is a measure of the density of essential nutrients, which is determined by both pre- and post-harvest conditions. For FV, nutritional quality is highest at harvest and progressively declines thereafter, except in the instance when the product was picked unripe and has a clear maturation process (Bengtsson, Norway, & Hagen, 2008). A recent review of the literature on post-harvest nutritional quality changes revealed that optimum post-harvest conditions differ by product, variety, and maturity (Bengtsson et al., 2008). If these optimum conditions can be achieved and maintained – through the control of temperature, light, humidity, and circulating oxygen and carbon dioxide – nutritional quality declines often slow or level off. Processing has differential effects on nutritional quality, depending on the type of processing, the product, and the nutrient. Although an area of considerable interest, relatively little research has been done on the effect of post-harvest handling on nutritional quality (Bengtsson et al., 2008).

Nutritional quality is predominantly a credence attribute, as it usually cannot be determined by the consumer even after consumption. For example, it is difficult and costly to detect the extent of vitamin C deterioration in a tomato and therefore extremely unlikely to be carried out by a consumer. Other features (e.g. appearance) are more likely to act as indirect indicators for nutritional losses, but are covered conceptually in this thesis under food acceptability. Therefore, nutritional quality will not be assessed in this thesis.

Based on these conceptual understandings and drawing heavily from the work of Hawkes and Ruel (2011), the framework used to inform the analysis is presented in Figure 5.

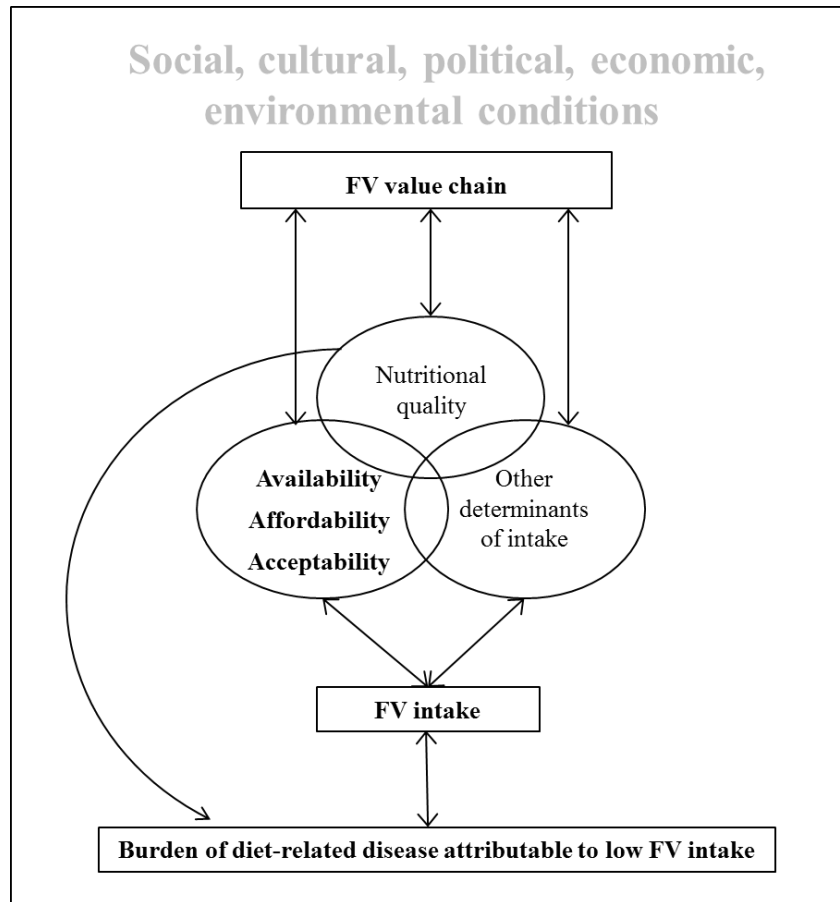


Figure 5. Conceptual framework for research

4.3 Methodological approach

This study employed a mixed methods case study design, incorporating a range of (primarily qualitative) methods to examine Fiji's FV sector. Given the complexities of the food system and the interdependent nature of value chain actors, multiple methods were integrated to enrich each other and generate a more comprehensive representation. Case study research describes the in-depth investigation of a single 'case', such as a person, event, or process. Yin (2009) has suggested that the case study approach is particularly appropriate when three criteria are met: (1) the research question is explanatory (asking how or why?); (2) the researcher is studying a

contemporary phenomenon, but has little control over events or the behaviour of the subjects; and (3) there is a need to produce an in-depth understanding of the phenomenon within its context.

This study meets all three criteria by seeking a detailed understanding of both how and why FV value chains organise and operate as they do. According to Easton (2010), case study research is consistent with critical realism, which supports in-depth investigation of why things are the way they are. Case study research is also compatible with a systems framework (Anaf, Drummond, & Sheppard, 2007), as the approach focuses the work by setting clear parameters around what is being studied (the system/case) while maintaining the systems theory principles of interrelatedness and interdependence between the elements in the system/case.

Case study research is particularly well-suited for the investigation of the structure and function of value chains, as it “allows the researcher to tease out or disentangle a complex set of factors and relationships, albeit in one or a small number of cases” (Easton, 2010, p. 119). Accordingly, case studies are arguably the most common research method used for value chain analysis by strategic business management researchers. As noted in Chapter Three, specific value streams are the primary unit of analysis and the focus is on building an in-depth understanding of the challenges and opportunities that arise from activities and relationships therein. Sterns, Schweikhardt, and Peterson (1998) argue that for agri-food chains, the intensive nature of case study methods can uncover the “motivations and strategies underlying decisions that are, in practice, far more complex than a simple decision rule like “maximize profits” and “minimize costs”” (pp. 311-312). The approach thus generates a great deal of data on the chain that can be analysed and interpreted to provide a basis for devising improvement projects. Alternative approaches, including archival and historical study and survey methods, were ruled out as appropriate for this research project, given that the topic requires analysis of real-time value chain processes, description of contemporary challenges and perceptions, and a particular attention to ‘how’ and ‘why’ questions (rather than ‘what’, ‘when’, and ‘where’).

In this study, triangulation (Eisenhardt, 1989b; Mays & Pope, 2000; Patton, 1999), respondent validation or ‘member checking’ (Fade, 2003; Mays & Pope, 2000), and analytical documentation (Mays & Pope, 2000) were used to increase the validity and reliability of the findings. Triangulation has been applied previously to qualitative research on Fiji’s agricultural system (Bachmann, 2001) and is common in value chain research (Kaplinsky & Morris, 2000). As is typical in case study research, the emphasis was on generating transferable, rather than generalisable, findings (Pope & Mays, 1995). To do so, information about the context and particulars of the Fijian FV sector are detailed in Chapter Six and possible similarities and differences between this case study and other similar settings are discussed in Chapter Nine.

4.4 Fieldwork site selection and research ethics approval

To respond to the need for evidence on the utility of value chain analysis as a tool to identify opportunities to increase the supply of and demand for nutritious foods by the poor (Hawkes & Ruel, 2011), a decision was made to focus on FV intake based on its importance to the prevention of diet-related disease (Lock et al., 2005; WCRF/AICR, 2007; WHO & FAO, 2003). Thus site selection required identifying a site with evidence of low FV intake, as well as the potential for strengthened domestic horticultural value chains. A short list of potential sites in Africa, the Caribbean, and the Asia-Pacific region was developed and shared with the PhD candidate’s Advisory Group in September 2011. Fiji was determined to be the most suitable option, based on its high rates of chronic disease, inadequate FV intake (Ministry of Health, 2014), policy commitment to both horticultural production (Ministry of Primary Industry, 2009) and addressing low FV intake (Lachat et al., 2013; Ministry of Health, 2010a; National FPAN Advisory Committee, 2010; NFNC, 2008b), and a strong interest in replacing FV imports with local supplies (Ministry of Primary Industry, 2009). A three week feasibility site visit was conducted by the PhD candidate in October 2011, with logistical support from the Pacific Research Centre

for the Prevention of Obesity and Non-communicable Diseases (C-POND), at the Fiji School of Medicine in Suva.

The NFNC, based in Suva, agreed to serve as the host institution for this project. The organisation's Acting Manager agreed to be the local co-investigator and the Research Officer served as a second local co-researcher (hereafter referred to as the 'local counterpart'). In addition, the PhD candidate partnered with the Research Division of Fiji's Department of Agriculture. Working collaboratively with these local institutions was critical to ensure the research was relevant and timely and built from existing knowledge and data. The Memorandum of Understanding between the project partners is attached in Appendix A.

In addition to the local co-researchers, the PhD candidate was supported by a Local Reference Group. Membership of this group included the co-researchers at the NFNC, the Director of Research and a Senior Agricultural Officer from the Department of Agriculture, and the C-POND Research Coordinator. The purpose of the Group was to provide practical advice to support the study's data collection and interpretation activities and enhance the quality, relevance, and local utility of the findings. The Group also played a central role in the selection of exemplar products. The Terms of Reference of the Group are provided in Appendix B. The Group met four times during the fieldwork period.

Value chain analyses focus on chains serving specific groups of consumers. As urban dwellers potentially face greater challenges to home food production in Fiji (Narsey, 2011a; Schultz et al., 2007) and urban populations suffer a disproportionate burden of NCDs in low- and middle-income countries (Alwan, 2011), the PhD candidate decided, in consultation with the NFNC, that the research would address the issue of low FV intake amongst Fiji's urban population. The largest urban and peri-urban area in Fiji, and the site of greatest population growth in recent

decades, is the corridor connecting the city of Suva and the town of Nausori (FIBoS, 2008).

Residents of this area were selected as the target population.

Ethical approval was required for this project from the Observational Research Ethics Committee at the London School of Hygiene and Tropical Medicine (LSHTM) and in Fiji from the Fiji National Research Ethics Review Committee. Ethical clearance was first given by LSHTM on March 26, 2012 (Ref. 6144). In Fiji the research ethics procedure for a foreign researcher requires prior clearance from her home university, endorsement by local hosts (Appendix C), endorsement of her study by the Ministry of Education (Appendix D), prior issuance of a research visa by the Department of Immigration, and completion of her application. The process of gaining local ethics clearance was facilitated by C-POND and took approximately five months. Clearance was given on May 16, 2012 (Ref. 2012 21). The approval of an amendment to increase the total number of study participants was granted by the Fiji National Research Ethics Review Committee on October 16, 2012 and LSHTM on November 21, 2012.

4.5 Study design and methods

Descriptive analyses of existing data and new data collection through fieldwork were used to meet the research aim and objectives. As highlighted in the literature review (Chapter Three), strategic business management approach or framework to value chain research typically involves identifying value from the perspective of the target consumers; mapping the actors in the chain, the relationships between them, and the activities they perform; and identifying and analysing where, how, and why value is added or resources are wasted (Bonney et al., 2007; Fearne et al., 2012; Taylor, 2005). Drawing from the value chain literature, the PhD candidate applied a five step study design to achieve the research objectives (Figure 6). The first two steps were covered in Chapters Two and Three.

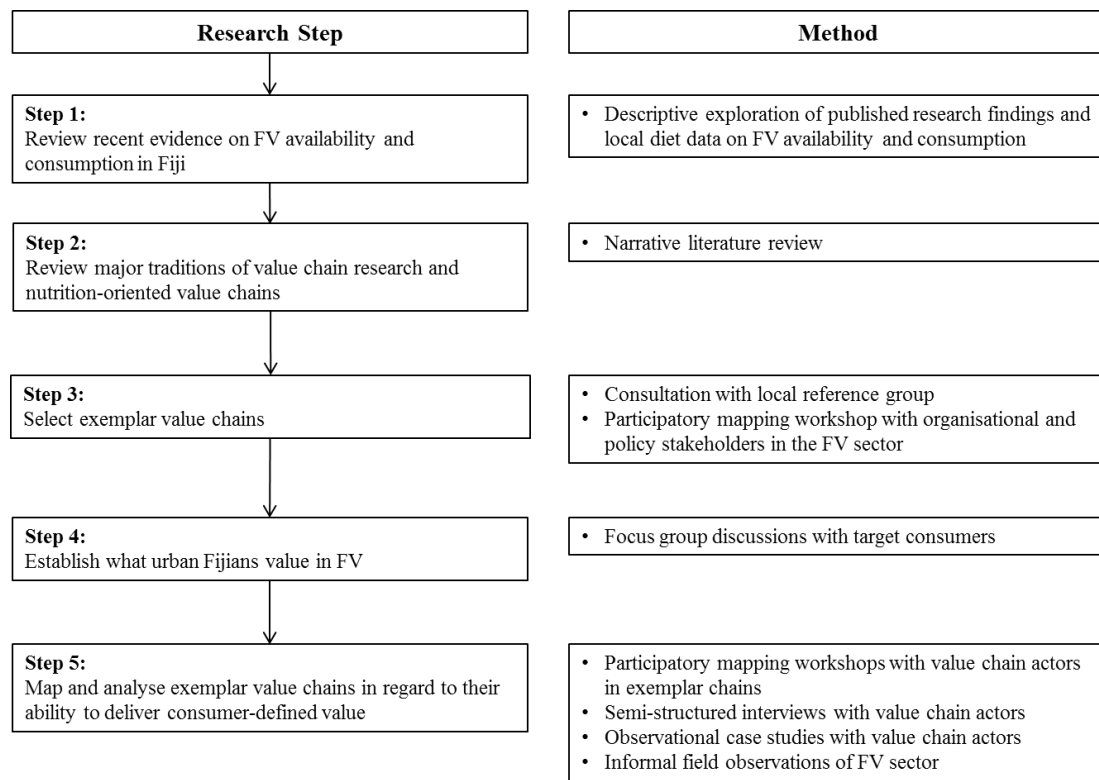


Figure 6. Research steps and related methods

4.5.1 Cross-cultural and cross-language research considerations

Qualitative health research methods have been used extensively to collect cross-cultural and cross-language data, but ensuring accuracy and validity poses particular logistic and analytical challenges (Hennink, 2007; Hsin-Chun Tsai et al., 2004). For example, researchers may not be fluent in the study populations' languages and cultures, including meanings and perceptions of health and disease. Inclusion of people on the research team who understand the culture and language of the participants is essential to collect and analyse adequately the data generated (Hsin-Chun Tsai et al., 2004). Thus, for this thesis, efforts were made to build a linguistically- and culturally-competent study team and language and cultural sensitivity was considered at all stages of the research.

With support from the local counterpart and C-POND, two local Fijian research assistants (RAs) – one of iTaukei descent and one of Indian descent – were recruited to join the study team. The RAs are university educated and have high sociolinguistic competence, i.e. they possess sophisticated oral and written communication skills between languages and the ability to integrate cultural expressions and meanings (Squires, 2009). Both RAs had experience with quantitative nutrition research, but only limited exposure to qualitative methods. The PhD candidate provided training for these assistants on qualitative methods in general, as well as specific instruction on each of the data collection activities in which they were involved. The intent was in part to build their capacity in qualitative methods and value chain research so that they would be able to carry out or provide local support on this sort of work at a later date.

4.5.1.1 Data collection

The role of the local counterpart and RAs with language translation and interpretation was vital to the research. During project planning, the local counterpart helped develop the study's Participant Information Sheets and Consent Forms (Appendix E) and, together with the RAs, translated these documents from English to Hindi and Fijian. As described later in this Chapter (Sections 4.5.3.1 and 4.5.4.2), the RAs supported study recruitment, co-moderated the focus group discussions in Hindi and Fijian, provided oral translation services for about a quarter of the semi-structured interviews, and transcribed and translated the data they collected with the PhD candidate. Using only one translator per language previously has been demonstrated to maximise reliability (Twinn, 1997). Excerpts from transcripts were verified by a second person for accuracy (Squires, 2009).

A primary concern with the use of translators and interpreters is that the meaning of participants' accounts will be changed or lost, thereby affecting the accuracy of the study's findings (Hsin-Chun Tsai et al., 2004; Squires, 2009; Twinn, 1997). Throughout the fieldwork period, the research team discussed the importance of 'conceptual equivalence' when interviews were being

translated to English. As abstract concepts may not be shared between different languages, conceptual equivalence is achieved when the translator provides a technically and conceptually accurate translation rather than focusing on rigid grammatical rules (Jandt, 2010; Squires, 2009).

4.5.1.2 Data coding and analysis

In addition to data collection, there are also important analytical considerations for cross-cultural, cross-language qualitative research. According to Hsin-Chun Tsai et al. (2004), a benefit to involving ‘insiders’ (members of the studied population) in data coding and analysis in cross-cultural research is that they often are better able to comprehend participants’ beliefs and actions. However, there are also advantages of being an ‘outsider’. For example, outsiders may notice behaviours or concepts that are culturally unique and recognised only by those from other cultural groups. Outsiders’ limited acquaintance with the phenomena under study may also reduce the risk that reporting will reflect their own experiences rather than those of the research participants (Hsin-Chun Tsai et al., 2004). In light of these arguments and given the training requirements of a PhD degree, data coding and analysis were carried out by the PhD candidate (see Sections 4.5.3.1.3 and 4.5.4.4 below), but local members of the research team used their knowledge of local socio-cultural systems to help her understand the context of participants’ comments and subtle cultural meanings. As presented in Section 4.5.3.1.3 below, the local counterpart also supported data analysis by double-coding a subset of the focus group data and assisting with the development of an initial coding template.

4.5.2 Select exemplar value chains

This section details the methods used to select exemplar products and streams. The purpose of this formative part of the research method was to delineate the boundaries of the value chain case studies. As noted in Chapter Three, a ‘value stream’ is a distinct pathway in which a specific product or product family (a group of products that pass through similar steps) reaches a specific consumer market (Rother & Shook, 1998; Womack & Jones, 1996, 2002). Four components to

consider in the selection of a value stream were usefully identified by da Silva and de Souza Filho (2007): product, components (scope of actors and activities), geographical coverage (i.e. where the chain starts, transverses, and ends), and time frame.

A participatory approach was used to prioritise potential FV products and value streams.

Participatory research describes a range of approaches which share in common recognition of the importance of engaging local people in the research process, rather than seeking their participation solely as research subjects (Cargo & Mercer, 2008; Cornwall & Jewkes, 1995).

Three key strengths of participatory approaches are that they build on existing knowledge and experiences, they can optimise the use of limited resources, and they increase the likelihood of the research findings being utilised by the research beneficiaries. Participatory approaches capitalise on the integration of the researchers' theoretical and methodological expertise and local people's knowledge of the real-world context. Engaging stakeholders in the formative stages of research can save time and money over the long term and increase the commitment of research stakeholders to use the findings to take action (Cargo & Mercer, 2008). The importance of this commitment to ensuring research relevance is echoed across the value chain literature (Bonney et al., 2007; Fearne et al., 2009; Rother & Shook, 1998; Simons et al., 2003; Taylor, 2005; Womack & Jones, 2002).

4.5.2.1 Product selection through consultation with local Reference Group

In June 2012, the local Reference Group was convened and descriptive statistics from the NNS were reviewed to inform the choice of three exemplar products to be the focus of subsequent data collection. The target was to select products that would be emblematic of different types of local FV and different types of local value chains. Therefore six criteria, chosen to balance cultural, diet, and supply issues with the case study aims, were used to refine product selection:

1. Acceptable to both major ethnic groups (iTaukai and Indian) as determined by most households currently including the product in their diets (Table 1, p.44), to ensure research does not bias one group;
2. Not presently consumed by most households on a daily basis (Table 1, p.44), to ensure scope for increased dietary intake;
3. Unique nutritional sub-group of FV (e.g. dark leafy green, red and orange, etc...), to capture dietary diversity and foods consumed in distinct meals or situations;
4. Commercial year-round domestic production (acknowledging seasonal supply variation) (Table 1, p.44), to ensure research is not limited in relevance to a single season;
5. Unique post-harvest management, to shed light on a range of post-harvest practices; and
6. Unique value chains, to represent different dimensions of the local supply system.

Reference Group members were provided with a table indicating consumption frequency for each FV by ethnicity and a copy of the product selection criteria. The Group discussed each product in turn and identified amaranthus (*Amaranthus viridis*, a leafy green vegetable known to iTaukeis as ‘tubua’ or ‘moca’ and Fijians of Indian descent as ‘chauraiya’ or ‘bhaji’), papaya (*Carica papaya*, referred to locally as ‘pawpaw’ or ‘papita’), and tomatoes (*Lycopersicon esculentum*) as meeting all criteria and thus selected them as the exemplar products for the study. Brief descriptions of each product are provided in Appendix F.

4.5.2.2 Stream selection using mapping workshop with FV sector stakeholders

The generation of simple maps can be valuable for delimiting the value stream(s) under study (da Silva & de Souza Filho, 2007; Taylor, 2005). Bringing together an interdisciplinary group of experts is the preferred approach to mapping as it capitalises on existing expertise and provides a forum for stakeholder engagement and interaction (Rother & Shook, 1998; UNIDO, 2009).

Participatory mapping workshops have been used extensively as a research method in developing countries (Cornwall & Jewkes, 1995) and have previously been used in agri-business value chain

research (Simons et al., 2003; Taylor, 2005). Through participatory mapping, “researchers become learners and facilitators” (Cornwall & Jewkes, 1995, p. 1668) as the process gains momentum through the contributions and interaction of the participants. In this study, a small participatory mapping workshop with policy and organisational stakeholders in the FV sector was used to guide stream selection for the exemplar products.

4.5.2.2.1 Workshop recruitment and sample

Workshop recruitment was aimed at decision-makers in FV supply chains. Potential participants (aged 21 and older) were identified in consultation with local partners in July 2012. Three representatives from different divisions of the Department of Agriculture and a senior market representative from one of the municipal markets agreed to attend.

4.5.2.2.2 Workshop facilitation

The workshop (hereafter referred to as the ‘basic systems mapping workshop’) was held at the NFNC office in Suva in August 2012 and facilitated in English by the PhD candidate, who also developed all workshop materials. Organisational assistance was provided by the local counterpart. Written informed consent to participate and be audio-recorded was obtained from participants prior to commencement of the workshop (see Participant Information Sheet and Consent form in Appendix E). In line with local custom, participants were reimbursed for travel and refreshments were provided. No other compensation was given.

A range of map templates exist in the value chains literature, each with a slightly different emphasis depending on the goals of the creator. As the purpose of this workshop was to support value stream selection, it was determined that a simple template would be adequate. The ‘basic map’ template created for USAID to support value chain development in developing country contexts (MicroLinks, n.d.) was selected for its straightforward format and flexibility for use in participatory mapping. The approach focuses on identifying and illuminating three aspects of the chain: the functions (e.g. production, transport), participants (e.g. growers, retailers), and

supporting systems (e.g. technical advisors, the finance sector). It was modified by the PhD candidate to reduce the time needed and increase the specificity.

At the start, a brief presentation summarised the purpose and planned mapping process, which involved three interlinked activities for each product: brainstorming to prepare for mapping, mapping, and identification of promising value streams to investigate in greater detail. The first activity consisted of free-form identification of the functions and actors involved in the value chain. Using the ideas generated through this brainstorming, the participants were then asked to create a basic representation of who does what in the chain, by building on to the simplified map template. This template contained the three dimensions of the USAID ‘basic map’: the major activities in the chain (‘functions’); the various actors involved in each activity (‘participants’); and supporting systems (‘supporting systems’). To ensure a focus on chains supplying the exemplar products to Suva-Nausori consumers and speed up the process, participants were provided with a provisional list of outlets where the target consumers obtained FV (but given the opportunity to suggest changes).

To make it easier for the group to discuss aspects of each map, the names of different functions, participants, and supporting systems were written on coloured slips of paper as they were mentioned. These slips were then shifted around the map until the group came to agreement on their placement, at which point they were taped down. When there was additional information on a specific component of the map, stakeholders wrote this information on a post-it note and placed it beside the relevant component. To simplify the map for readability, relationships between actors were not shown.

Maps were completed in their entirety before the group progressed to the third and final activity: selection of the two to three value streams which participants felt held the greatest potential for increasing intake by Suva-Nausori consumers. Using connecting lines to show relationships

between different actors, the group created a basic schematic map of the selected pathways on a blank sheet of paper. The group was reminded that the selected pathways should have room for improvement as they would be the focus of the remainder of the study.

4.5.2.2.3 Verification meetings

Following the workshop, the PhD candidate transferred the maps to electronic format using Microsoft PowerPoint, compiled detailed notes on the workshop proceedings, and scheduled individual meetings with each workshop participant (within one month). These one-to-one meetings provided a simplified form of ‘member checking’ (Fade, 2003; Mays & Pope, 2000) and were designed to verify the content of the maps and ensure that participants were happy that they were not identifiable. A similar two-step approach (i.e. workshop followed by individual meeting) involving a range of food system stakeholders has been applied previously to nutrition research in the Pacific Island countries (Snowdon, 2009).

During the verification meetings, participants were asked to review the electronic version of the maps, comment, and suggest any revisions. Immediately after each meeting, the maps were updated with the suggested changes in red. The most updated maps were then shared at the next verification meeting for review, without indicating who suggested the proposed changes. The final maps thus incorporate the incrementally agreed edits from the verification meetings.

4.5.2.2.4 Outputs

The notes of the workshop and all versions of the basic systems maps were saved in a sub-file in the study’s Nvivo data file. These workshop outputs formed the foundation for subsequent inquiry, and were drawn on in the analysis phase. Using these data, the PhD candidate and local counterpart identified one stream for papaya, one stream for tomatoes, and two streams for amaranthus to be the focus of further investigation. These specific streams are hereafter referred to as the ‘exemplar chains’. For papaya and tomatoes the exemplar chains involved production in Sigatoka and sales in Suva-Nausori markets, and for amaranthus the exemplar chain involved

production in the Suva-Nausori corridor and sales through markets and door-to-door vendors.

The exemplar chains are outlined in greater detail in Chapter Six.

4.5.3 Establish what urban Fijians value in FV

Consumer-orientation forms the basis of the value chain approach. In this study, the intent of the consumer research was to identify what the target consumers value or find acceptable in the FV food group and the exemplar products specifically (Objective Two).

4.5.3.1 Focus group discussions with target consumers

The aim of focus group methods is to gather a range of opinions and experiences, rather than for the participants to reach an agreement on the issues discussed. Interaction between participants is the distinguishing feature of the method; the group context provides participants greater opportunity to raise and discuss issues of importance to them than is present in one-to-one interviewing and also more closely replicates natural social interaction (Hennink, 2007; Kitzinger & Barbour, 1999). Limitations include possible challenges with group dynamics, the advanced skills required to facilitate groups, and limitations related to the data (Hennink, 2007). In the strategic business management approach to value chain analysis, focus groups can “shed light on consumer attitudes and perceptions towards the product category, how purchase decisions are made and the range of attributes that are influential therein” (Fearne et al., 2009, p. 10).

4.5.3.1.1 Recruitment

Recruitment for the eight focus groups was carried out via existing religious and community groups in the Suva-Nausori corridor. This approach was used as previous focus group research by the NFNC utilised a door-to-door recruitment strategy, but found participant shyness to be an obstacle to eliciting fruitful discussion (P. Vatucawaqa, personal communication, November 7, 2011). Therefore, this study based recruitment on existing local social groups to ensure familiarity amongst participants, i.e. ‘affinity’ groups (Mackay, 2012). Meeting with others whom participants view as possessing similar characteristics can help increase the appeal and

comfort of participation in focus groups (Mackay, 2012; Morgan, 1997) and drawing on pre-existing groups capitalises on the networks in which people might naturally discuss the topic of the session (Kitzinger & Barbour, 1999; Mackay, 2012), i.e. food value and choice. The recruitment approach also made certain that participants were from the same local vicinity and shared a common language and ethnicity.

Women are the primary food shoppers and preparers in Fiji (Schultz et al., 2007) and were thus the focus of recruitment (approximately 75%). The PhD candidate initially contacted the National Council for Women in Fiji, the Fiji Women's Federation, the Young Women's Christian Association (YWCA), the Fiji Muslim League, and Shree Sanatan Dharm in June and July 2012 to explain the purpose of the study and request to be linked with leaders of their affiliate groups. All bodies expressed interest in the project and potential groups were identified through the YWCA, Fiji Muslim League, and Shree Sanatan Dharm. Two further groups were recruited through existing NFNC community contacts in July 2012. The researcher selected recruitment groups based on a balance of gender, ethnicity, and geography. Four groups with iTaukai membership and four with Indian membership were selected. Two of the groups were based in Suva, two in Nausori, and four in the peri-urban corridor connecting the cities.

For each group, contact was first made with the leader or, when no leader existed, a selected representative. The PhD candidate briefly explained the project and the focus group research to this person. If the person indicated that the study sounded of possible interest to the group, an appropriate time and venue to hold a recruitment session were determined and a poster to advertise the upcoming recruitment session was provided. Typically, the recruitment sessions were held either directly preceding or following the groups' regular weekly or bi-weekly meetings. Recruitment sessions were scheduled at least five days prior to the focus group.

During the recruitment sessions, each part of the Participant Information Sheet (English version in Appendix E) was explained by the PhD candidate in English and by an RA in either Fijian or Hindi, and time was provided for questions. Those interested in participating (up to eight persons), were asked to complete a consent form and provide a name and contact number so that (s)he could be reached with a reminder call. Recruitment aimed for six to eight persons per group, in line with recommendations for focus group research in developing countries (Hennink, 2007). At each recruitment session, at least six persons expressed interest in participating and at some sessions greater than eight persons indicated interest. In this situation, the first eight were signed up and the names of the other interested persons were noted in case spaces opened up. Field notes for each recruitment session were typed and added to the study's data file. Consented participants were given a reminder call and if they noted they would not take part and a waiting list had been created for that group, persons from that list were contacted and invited to participate. At some groups, persons who had not previously provided informed consent came to take part and, if fewer than eight consented participants arrived, these people were invited to participate after completing the consent form.

4.5.3.1.2 Moderation

Each focus group was held at a quiet and private location selected by the group, normally one of its usual meeting sites. Five of the eight sessions were held during the groups' established meeting time slots, and others were held at a time chosen by participants. All groups were moderated in English by the PhD candidate, with Hindi or Fijian co-moderation by an RA. This format was selected because nearly all participants were comfortable participating in English, but some preferred to express certain experiences, ideas, and opinions in their native local language. The moderator led the discussion, with the co-moderator repeating questions in the appropriate local language. Probing was done by both the moderator and the co-moderator, depending on

which language was relevant at the time of the probe. Participants were encouraged to respond in the language in which they were most comfortable.

Each focus group began with an introduction in both English and the appropriate local language, which explained participation and the format of the session. The semi-structured topic guide (Appendix G) was based on the research question and the food choice literature. Topics included the sources of FV, motivators for including them in the diet, determinants of product choice (i.e. decision-making factors), and preferred preparation techniques. These topics were explored for FV as a food group and also for the exemplar products individually. The topic guide allowed for moderator flexibility and enabled participants to describe experiences and raise issues that were relevant to them. Probes were derived from the food choice literature (Brunsø et al., 2002; Pollard et al., 2002) and sought to generate discussion on what qualities the participants value in FV, cues used to signal quality, and the importance of price in FV purchasing. A pilot focus group was held in April 2012 and aided the refinement of the topic guide and identification of culturally-appropriate and contextually-relevant wording for questions and probes.

The discussions were mostly relevant to the research questions; however, commonly reported interviewing challenges were experienced in a few cases, including distracted participants and dominant participants (Hennink, 2007). In the first focus group, the discussion was interrupted multiple times by side conversations and phone calls, thus prompting the PhD candidate to revise the introductory script to explain the need for participants' undivided attention and request mobile phones be turned off. Following this revision, these disturbances were not an issue. Further, in some groups, particularly the first group, the discussion was dominated by one or a small number of highly vocal participants. During these sessions, the moderator worked to elicit responses from other participants with non-verbal cues and standard probes, such as, "What do others think?" (Hennink, 2007).

The length of the discussions – including the introduction to the group and any interruptions – ranged from 45 to 90 minutes, but the average session lasted about an hour. Sessions were audio-recorded with participant approval. Handwritten notes were taken by the co-moderator during the session and field notes were taken by the moderator following the session. These notes were later typed and added to the study's data file to provide context on the discussion. Participants were not compensated for participating in the group; however, following the session, refreshments were provided, as is common locally.

4.5.3.1.3 Data preparation and analysis

The audio-recordings of the focus groups were transcribed verbatim by a trained RA following procedures outlined by Macnaghten and Myers (2004). Any non-English segments were translated to English and verified by a second person. The researcher checked all transcripts against audio-recordings twice for accuracy. Audio-recordings, transcripts, session notes, and field notes were entered and stored in a secured data file in QSR Nvivo 9.2, a qualitative data management software package.

Qualitative analysis of the focus group transcripts was guided by the template analysis approach (King, 2004). Template analysis involves the development of a hierarchical list of codes (known as the 'template') representing themes in the data. Based on the research question, some codes are determined *a priori* and others are generated from the data. As noted by King (2004), template analysis falls between content analysis where all codes are defined *a priori* and grounded theory where no codes are pre-determined. The analytical approach is suited particularly for applied research.

The analysis focused on two main questions: (1) what constrains FV consumption amongst urban Fijians? and (2) what motivates and incentivises FV consumption in this population? The means-end chain model underpinned exploration of the second question, with consideration of multiple layers of information abstraction. At the highest level, major consumption motives were assessed

(i.e. why include FV in the diet?). Next, the product qualities and attributes valued by consumers were examined. Finally, the specific product characteristics on which urban Fijians base their quality evaluations were considered.

Based on dimensions of quality from the TFQM (Brunsø et al., 2002; Grunert et al., 1996) and initial reviews of the transcripts, the PhD candidate determined key themes in the data to be used as *a priori* codes and created a provisional template. The PhD candidate and local counterpart then independently examined a subset of the transcript data (two focus group discussions) using the template and met to review their coding decisions line by line, clearly define how each code should be used, and consider each other's suggestions for modifying the template. This process informed the development of a more succinct and unambiguous initial template which was used by the PhD candidate to examine systematically and code all focus group transcripts. Following a complete coding of the data, the template was refined further and all transcripts were re-visited in full.

4.5.4 Map and analyse exemplar value chains

The analysis of the exemplar value chains combined additional participatory mapping workshops, in-depth interviews, and direct observations of the processes in the chain. This combination of methods was chosen to map the activities, actors, and relationships in the exemplar streams, and to identify why the exemplar streams are organised and function as they do and the consequences for availability, affordability, and acceptability in Suva-Nausori markets (Objectives Three and Four). Triangulation of sources was used to increase confidence in the final results (Eisenhardt, 1989b; Mays & Pope, 2000; Patton, 1999). Data collected from people with different roles in the food supply were compared and, when possible, different forms of data collected on the same value chain business were examined. Findings from the workshops, interviews, and observations are presented in Chapters Six, Seven, and Eight.

4.5.4.1 Mapping workshops with actors in the exemplar chains

As noted in Section 4.5.2.2, participatory mapping is a commonly applied data collection method in value chain analysis. In addition to supporting selection of the exemplar chains, mapping workshops were used in this case study in the detailed investigation of the exemplar chains. The group method was selected to complement one-to-one interviewing and observation methods, as information shared in individual and group contexts can differ (Kitzinger & Barbour, 1999). The workshops had a primary objective of identifying the activities, actors, and relationships in the exemplar chains. However, they also served two other important purposes: to generate data on actor perceptions and opinions of material flow, information flow, and relationships in a group context, and to provide an opportunity for further validation and verification of the basic systems maps.

4.5.4.1.1 Recruitment

Participants were identified through purposive and snowball sampling. Initial suggestions of participants and recruitment sites were given by FV sector stakeholders involved in the basic systems mapping workshop. Recruitment was carried out by the PhD candidate in September and October 2012 and focused on markets and farming areas serving the Suva-Nausori corridor.

To be eligible to take part, potential participants needed to be aged 21 or older, have strong English language skills, and have expertise in at least one of the exemplar value chains. To persons meeting the criteria, the basic purpose and structure of the workshops was explained and the Participant Information Sheet (English version in Appendix E) was provided. If interested, these persons were asked to provide a name and contact number where they could be called several days prior to the workshop to confirm whether they would like to take part. For those who confirmed that they would take part, a reminder call was also given the day before the workshop.

In an effort to obtain a desired group size of four to five people, up to seven persons were initially invited to each group. This aligns with the literature on group-based research which advises over-recruitment, as people may change their minds about participating or fail to show up the day of the workshop (Hennink, 2007; Morgan, 1997). Nonetheless, attendance was a key challenge at every session. In total, 15 persons participated in these mapping workshops: two in the pilot, five in the amaranthus workshop, three in the tomato workshop, and five in the papaya workshop.

4.5.4.1.2 Pilot workshop

A pilot workshop on amaranthus was held in October 2012 and was followed by pilot verification meetings. These trialling activities provided an opportunity to try out the workshop format and test the facilitation method. At the beginning of the pilot, nearly 30 minutes were spent reviewing and adding missing information to the basic systems map created by FV stakeholders, thus curtailing the time available for the other, more substantive activities. The provision of only a brief explanation of the method and use of a passive facilitation style resulted in limited discussion on what happens in the exemplar value chain and a correspondingly simplified map.

The experience of the pilot suggested that a thorough explanation and example of the planned mapping method should be provided at the start of the workshop, an active facilitation approach should be used, and the first activity should be the generation of the detailed exemplar chain map. Further, it was determined that perfecting the basic systems maps should not be a priority, as doing so would be time-intensive and these maps were intended as a planning tool. Following the pilot, revisions to the workshop format and facilitation style were made in line with these lessons learned.

4.5.4.1.3 Workshop facilitation

The workshops (hereafter referred to as the ‘detailed chain mapping workshops’) were held in October and November 2012 and facilitated in English by the PhD candidate. Department of Agriculture conference rooms were used for their proximity to participants’ homes.

Organisational assistance and note-taking was provided by an RA. Written informed consent was collected from participants before workshop commencement. Each two hour session was audio-recorded with participant approval. Refreshments were provided following the workshops and travel expenses were reimbursed. No other incentives or reimbursement were offered.

The mapping process applied in the workshops was based on the ‘current state’ mapping approach developed by Rother and Shook (1998) for a single manufacturing firm and then extended to the context of interlinked firms by Womack and Jones (2002). The process seeks to generate a schematic of how products and information flow through the chain (Womack & Jones, 2002). To do this, representatives from each firm are brought together to develop a list of the sites in the chain, the physical actions that happen at those sites, and the total time spent on each action. The contribution of each activity towards generating value for the consumer is also determined and noted. This information is then used to draw a map of the value chain based on a standard template depicting three main elements: physical flow of products, the information flows, and a timeline of the process. Key features are illustrated on the map using a set of standard icons and text boxes.

Although applied previously in the agri-food sector (e.g. Simons et al., 2003; Taylor, 2005), the process has not been used extensively on the fresh FV sector in developing countries and therefore needed to be adjusted to the research context. Particular considerations were the fragmented nature of the sector and the limited time actors would have available to participate. The PhD candidate therefore modified the technique in four main ways: first, by recruiting representatives of links rather than specific firms; second, by omitting the explicit allocation of value to each activity; third, by reducing the emphasis on the time spent on each action (following Bonney et al.’s (2011) recommendations to agri-food chain analyses); and finally, by simplifying the standard template to meet the local setting.

The workshops began with an overview of the different tasks to be completed and a detailed example of the planned mapping process. During the workshops, participants were asked to work together to map the chains for which they had experience. The mapping began with the PhD candidate guiding the participants through creation of a list of potential sites (e.g. farm, market) and specific physical actions (e.g. spray leaves with pesticide, load crates with fruit). After reviewing the list and reconciling any unresolved information, participants worked together to populate the map template with the necessary particulars. This involved inserting details from the list of physical actions and discussing the best possible information to fill the remainder of the map. Aspects of the map for which the participants did not have expertise or knowledge were left blank. Discussion around the suitability of the parameters of the map and differences in how and why participants perform specific activities were captured in the audio-recording.

To instigate discussion around product value, participants then were asked to sort and re-sort a pile of the exemplar FV product into visual categories which roughly reflect their use, following methods developed by Compton and Sherington (1999) for creating a scale of product damage. The sorting process ceased when consensus was reached about the boundaries of each category. Participants were asked to define and describe each category.

Finally, no more than ten minutes was spent verifying the basic systems map from the workshop with FV sector stakeholders. To do this, participants were shown individual segments (i.e. the list of functions, the list of participants at each function, the list of supporting institutions and systems, and the pathways selected for their potential to increase consumption in Suva-Nausori) and asked to indicate if they perceived anything to be missing or inaccurate.

4.5.4.1.4 Verification meetings

Workshop proceedings were compiled using the audio-recordings and maps. Because of the small sizes of the groups, individual voices could usually be distinguished and comments were attributed to specific respondents. The PhD candidate also generated electronic versions of the

maps using Microsoft PowerPoint. Any gaps in the maps were filled in later with information collected in semi-structured interviews.

The PhD candidate contacted each participant in the weeks following the workshops to schedule a one-to-one verification meeting. These meetings were held at participants' homes or workplaces and in most cases took place within one month of the workshop. As with the verification meetings with FV stakeholders following the basic systems mapping workshop, these meetings provided a simplified form of 'member checking' (Fade, 2003; Mays & Pope, 2000). During these meetings, the workshop outputs were reviewed and participants were asked to comment and suggest additions and revisions, particularly if their experience differed from what was represented in the data. In addition, the PhD candidate asked participants to clarify any unclear or incomplete statements made in the workshops. Edits and additions from the verification meetings were incorporated into the workshop proceedings using a different colour for every participant.

4.5.4.1.5 Outputs

Workshop proceedings and all versions of the maps were saved in the study's Nvivo file. The data generated through the workshops was immediately used to inform the development of wording for questions and probes to be used in semi-structured interviews. Following the completion of fieldwork, the workshop proceedings and maps were analysed together with data from the semi-structured interviews and observations, as described below.

4.5.4.2 *Semi-structured interviews with actors in the exemplar chains*

A strong value chain map shows how the chain is structured and indicates how it functions, but not *why* the chain organizes and operates as it does. To do this requires examining the influences on actors' behavior and the nature of relationships between them. Semi-structured interviewing is widely used in value chain analysis for this purpose. In a semi-structured interview, the researcher guides the interview around a pre-prepared list of questions or topics related to the research aims and objectives (Minichiello, Aroni, Timewell, & Alexander, 1990). The wording

and order of questions is not fixed and the interviewer is free to pursue new lines of questioning as information emerges.

According to Hennink (2007), in-depth, one-to-one methods are a particularly suitable data collection method when the aim is to identify individual perspectives, gather detailed information, or explore sensitive or complex topics. Thus, in-depth, one-to-one, semi-structured interviewing was pursued in this study to explore actors' decision-making. The private context of a one-to-one interview allowed the researcher to delve deeper into social and personal matters than would have been appropriate in a group interview (Hennink, 2007), thereby supporting the sharing of potentially sensitive business information.

4.5.4.2.1 Recruitment and sample

Interview participants were selected based on their role in the exemplar value chains. In particular, growers, transporters, retailers, input suppliers, and technical advisors were sought. Purposive and snowball sampling was used to identify potential interview participants between November 2012 and March 2013. Recruitment was carried out in natural work settings along the exemplar value chains. Additionally, after each interview, the participant was asked to recommend other actors in the value chain; however only those recommendations considered of relevance to the research aim and emerging findings were followed up. Interviews continued until informants involved in each chain activity had been interviewed and to the point where theoretical saturation appeared to have been reached (Eisenhardt, 1989b).

There was no language requirement nor did participants have to travel to participate; however, only adults aged 21 and older were invited to take part. The PhD candidate led all recruitment, with translation support provided by RAs when necessary. During recruitment, the purpose of the interview was explained and if the person was willing to speak, a Participant Information Sheet (English version in Appendix E) was provided in the preferred language (English, Fijian, or Hindi). For those who expressed interest in participating, a date and time was selected for the

interview, ideally at the person's worksite. About half of participants opted for the interview to be conducted immediately. Prior to commencement of the interview, written informed consent was obtained. No incentives were offered to participants. A total of 43 interviews were carried out with people involved in the exemplar chains, most of whom were participants in multiple roles. For example, many participants who self-identified as farmers were also involved in retailing activities and considerable overlap was observed between the input supply and technical advising functions.

4.5.4.2.2 Method

Most interviews lasted between 30 minutes and one hour and all were conducted by the PhD candidate at a location selected by the participant, typically his or her place of work. In the case of farmers, most interviews took place at their homes. For about one quarter of interviews, an RA provided direct translation to Hindi or Fijian.

Interviews followed semi-structured topic guides based on the strategic business management value chain literature (Appendix H). The focus of the interviews varied according to the work of the participant, but the topic guides broadly covered three themes: material flow, information flow, and relationships (Bonney et al., 2007; Fearne et al., 2012; Taylor, 2005). Major topics queried relating to *material flow* were activities, costs, markets, and prices. *Information flow* was explored through questions related to perceptions of consumer value and ways of acquiring information. Key topics queried in regards to *relationships* focused on identification and selection of suppliers and customers; trust, cooperation, and commitment; power; challenges, conflict, and resolution; and satisfaction. The data collection approach was iterative, with ideas, experiences, and opinions raised in the data collection generating probes for subsequent interviews.

Most interviews were audio-taped; however a small number of participants declined to be recorded. During unrecorded interviews, hand-written notes were taken by the PhD candidate.

Following all interviews, field notes on the interview were compiled by the PhD candidate to provide general contextual information on the interview. All notes were typed by the PhD candidate within three days of the interview.

Where necessary, audio-recordings were transcribed verbatim following the procedures outlined in Section 4.5.3.1.3 (Macnaghten & Myers, 2004) and translations were verified by a second person. All audio-recordings, transcripts, and notes were entered and saved in the study's Nvivo file.

4.5.4.3 Formal observations of the activities along the exemplar chains

Within the strategic business management tradition, observations are a near universal component of value chain analysis. The researcher 'walks the chain' to gather a first-hand understanding of the actual material and information flows to gain an understanding of the whole, interlinked process (Bonney et al., 2007; Rother & Shook, 1998; Soosay et al., 2012; Womack & Jones, 2002; Zokaei & Simons, 2006). In their seminal book *Food Policy Analysis*, Timmer, Falcon, and Pearson (1983) argue the importance of observations in examinations of the agri-food sector:

[R]iding with a bag of rice as it changes hands repeatedly between the farm gate and retail stall and understanding the decisions made along the way will guarantee the analyst a better perspective on market decisionmaking [sic] and price formation than a host of statistical analyses done in the office. (p. 165)

4.5.4.3.1 Recruitment and sample

For each exemplar value chain, a sub-sample of interview participants was invited to take part in a case study observation. The recruitment strategy aimed to include value chain actors with a range of roles, practices, and linkages. Where possible, the PhD candidate sought to construct complete farm-to-market pathways including interview participants with upstream and downstream linkages. If an invited person expressed interest, a Participant Information Sheet (English version in Appendix E) was provided in the preferred language (English, Fijian, or Hindi) and dates for the observation were chosen. Written informed consent was obtained before

commencing observations. A total of 13 people (working in eight distinct operations) participated in the observations. It was not possible to carry out an observation of the exemplar tomato chain due to the destruction of produce and subsequent absence of Sigatoka tomatoes in the Suva-Nausori market following Cyclone Evan (December 15, 2012).

4.5.4.3.2 Observational approach

Observations took place over one to three days at the work site(s) of participants and were carried out by the PhD candidate. As with the interviews, no incentives for participation were provided. Observations focused on how, where, and by whom the product was handled, stored, and transported. When activities were not clear, the PhD candidate asked the participant for clarification. The PhD candidate took hand-written notes during and immediately following the observations, which were typed into a detailed narrative within three days. When participants were linked in an exemplar value chain, the notes on their operations were compiled in a single document. These files were then saved to the study's Nvivo master file.

4.5.4.4 *Data analysis*

Reviews of the data occurred concurrently with data collection so as to familiarise the PhD candidate with the data and allow her to identify and follow-up on emerging themes as data collection progressed. Interview transcripts, workshop transcripts, and notes from the mapping workshops and observational case studies were analysed together thematically following an inductive analytical approach that broadly followed three steps.

The first step involved familiarization with the data. As noted previously, the PhD candidate listened to each audio-recording and read all transcripts and data collection notes multiple times so as to immerse herself in the details of the data. From this, initial themes began to emerge from the data. These themes, together with ideas drawn from the study's research questions, informed the development of a small number of *a priori* codes for a basic coding template. Anchoring codes on this template covered basic business details, material flows/chain processes, information

flows, and relationships. In the second step, this template was applied to all data. Through this initial coding, new themes emerged and new codes were added to the template. Following a complete initial coding, the PhD candidate printed key codes for further paper-based review. Text classified under these codes was read and ideas and memos were noted in the margins. Important emerging themes were documented and used to inform the development of a more advanced coding template. The final step involved applying this template to the complete dataset. It is important to note that this did not constitute a ‘final’ template; throughout coding new themes emerged and the PhD candidate had to go back and re-examine already-coded documents in light of the new themes. Further, as the results chapters of this thesis were written, codes were continuously revisited and their suitability scrutinized. Thus, the template continuously evolved through an iterative process of analysis and writing.

4.5.4.5 Informal field observations

In addition to formal data collection, the PhD candidate conducted informal market surveys, visited production areas, and engaged with stakeholders in the agriculture sector. Informal activities in markets included tracking availability and prices of exemplar products weekly, shadowing Department of Agriculture staff as they conducted pricing surveys, and regularly visiting the pre-dawn wholesale market to understand better how the process works and who is involved. Field visits to farming areas were conducted both individually and accompanying Department of Agriculture staff members. These agricultural visits helped the PhD candidate identify major production sites for the exemplar products and observe the work of both farmers and the extension service. These activities were documented in field notes in order to provide the PhD candidate with greater insight into the other aspects of the thesis research, but were not formally analysed.

4.6 Conclusion

This chapter provides detailed information about the theoretical approach, conceptual framework, site selection, research design, and methods used in this study. The PhD candidate progressed through a series of methodological steps (Table 5) to determine what is currently known about FV availability and consumption in Fiji, understand the major approaches to value chain analysis and use this information to develop an appropriate research design, establish what the target consumers value in FV products, construct maps of a small number of exemplar chains, and investigate what underpins the activities in those chains which contribute to product availability, affordability, and acceptability to the Suva-Nausori population. The next four chapters present the findings of this research.

Table 5. Summary of fieldwork activities

Research Step	Method	Type of data	Sample size
Select exemplar value chains (Formative activity)	Consultation with local reference group	<ul style="list-style-type: none"> • Meeting minutes 	
	Participatory mapping workshop with organisational and policy stakeholders in the FV sector ('basic systems mapping workshop')	<ul style="list-style-type: none"> • Pictorial maps • Workshop proceedings 	<ul style="list-style-type: none"> • One workshop with four participants
Establish what urban Fijians value in FV (Objective Two)	Focus group discussions with target consumers	<ul style="list-style-type: none"> • Audio-recordings and transcripts • Field notes¹ 	<ul style="list-style-type: none"> • Eight focus groups with a total of 57 participants
Map and analyse exemplar value chains (Objectives Three and Four)	Participatory mapping workshops with value chain actors in exemplar chains ('detailed chain mapping workshops')	<ul style="list-style-type: none"> • Pictorial maps • Workshop proceedings 	<ul style="list-style-type: none"> • Four workshops with a total of 15 participants (including pilot)
	Semi-structured interviews with value chain actors	<ul style="list-style-type: none"> • Audio-recordings and transcripts or interview notes • Field notes¹ 	<ul style="list-style-type: none"> • 43 interviews
	Observational case studies with value chain actors	<ul style="list-style-type: none"> • Case study notes 	<ul style="list-style-type: none"> • Eight structured observations involving a total of 13 people
	Informal field observations of FV sector (market surveys and field visits)	<ul style="list-style-type: none"> • Field notes¹ 	

¹Field notes were collected to support data interpretation, but were not analysed.

CHAPTER FIVE: CONSUMER CHARACTERISATION OF FRUIT AND VEGETABLE VALUE

5.1 Introduction

This chapter presents and discusses findings from the focus group discussions with urban Fijians regarding their reasons for consuming FV. Its purpose within the broader value chain analysis is to identify the reasons for FV consumption amongst the target population and to characterise FV value from the perspective of consumers. The results focus on answering two main research questions:

1. What constrains FV consumption?
2. What motivates and incentivises FV consumption?

As noted in Chapter Four, the analysis was based on the means-end model, which proposes that a range of product attributes provide consumers with cues to quality (or product acceptability) and quality is desired because it helps satisfy consumption motives (Zeithaml, 1988). The attributes that signal quality are product-specific (even within a category of similar products), but the dimensions of quality can be generalised to groups of products (e.g. FV) (Zeithaml, 1988). The second research question on motivators and incentives addresses these different levels of information abstraction.

The results are divided into two main sections aligning with the research questions. Section 5.2.1 addresses constraints to FV consumption. Section 5.2.2 considers: (1) major motivators for consuming FV; (2) FV qualities valued by consumers; and (3) specific characteristics used by the target population to evaluate quality in the exemplar products. A brief conclusion is provided in Section 5.3.

5.2 Results

5.2.1 What constrains FV consumption for urban Fijians?

Across the focus groups the main perceived constraints on FV consumption were the interrelated issues of high prices and inconsistent availability. The role of price in FV decision-making was a major topic in all groups, with both iTaukei and Indian participants describing price as important to the choice of what to buy and where to shop. Participants demonstrated a high awareness of objective prices (i.e. actual prices), which they interpreted as either “expensive” or “cheap”. Fresh FV were highly regarded, however many participants expressed that their consumption of preferred FV was sometimes limited by cost. A few participants said they perceived a general increasing trend in the cost of FV over time.

Like for nowadays we just go for the cheap ones, eh? What we can afford. Yeah.
(iTaukei woman)

It's (papaya) very expensive -FJ\$4. We can't afford it. At FJ\$4 we can buy four loaves of bread... It's very expensive. Like I said, [our choice of]...food crops - like vegetables - go according to resources that we have... (iTaukei woman)

When shopping, several participants described having a set price that they expected to spend or were willing to spend on a product and then comparing what they would get in terms of quantity and quality for that price across multiple vendors (i.e. the “value for money”). When a product’s price exceeded a participant’s price point or the available options were not considered good value for money, alternative products were sought. Certain types of retailers were considered to be price leaders for specific products. For example, markets and door-to-door vendors were thought to be cheaper than supermarkets for local products, whilst supermarkets were considered cheaper for imported FV.

We just go around and see where it's cheaper... First we check in the market, then we go in the supermarket. If it's not cheap in supermarket, we have to go back again. Only for FJ\$0.20 or FJ\$0.30 we have to go back again to the market. (Indian woman)

I don't buy carrots in the market. This is why: because [in the] supermarket the quantity is large and you can buy it at a lesser cost. That's why I choose supermarket for carrot rather than the market. (iTaukei woman)

Participants understood that price was closely linked to seasonality and other factors that impact supply (e.g. severe weather events). When in season, participants perceived local fresh FV to be “cheap” and described maximising consumption; however, outside of a product’s growing season or following a natural disaster, participants noted supply shortages and prohibitively high prices. During these times, participants rely on those fresh local products that are available, processed FV, or fresh imported products. For iTaukeis this often means an increased dependence on leafy green vegetables, whilst for Fijians of Indian descent, tinned tomatoes are especially important for this purpose.

It's (amaranthus) there in every season so it's easy for us to buy. For example, for bean, sometimes it is out of season so it's [a] bit expensive but chauraiya (amaranthus) is always there in every season and it's [a] bit cheap for us. (Indian woman)

Like what I do, when it's (tomato) in season, I try to make use of it as much as I can, because once the thing is over then again we go for the tin one. Those that we get from overseas is very expensive to buy - just one or two [tomatoes] totals about FJ\$6 or FJ\$7. (Indian man)

Supermarkets - sometimes we buy vegetables there. Sometimes we buy tinned vegetables, you know, if it's out of stock in the market. Especially if we have a cyclone or things like that, then we have to go for the mixed [frozen] vegetables in the supermarket. (iTaukei woman)

Several participants expressed frustration with the inconsistent availability experienced for some fresh, local FV. This was contrasted with the ubiquitous availability and steady prices of imported products such as apples and carrots. For example, at the time of the focus groups, papaya was in short supply and priced highly due to flooding in the Sigatoka Valley. Multiple participants said that despite their desire to consume papaya it was simply unavailable or unaffordable.

Yes, [papaya is] very expensive: FJ\$4. I buy pawpaw every week before, but I haven't eaten pawpaw for the last two or three months because it's very expensive. Like I said, we buy according to what we can afford. (iTaukei woman)

Most of the fruits are on season, but bananas – it's an everyday [product] ... But other fruits, when it's in season, we try to use it as much as we can. Oranges are there, guava are there, mangoes [are there]. These [are] the local ones, but then if you can't find the local ones then mostly we get apples. (Indian man)

5.2.2 What motivates and incentivises FV consumption for urban Fijians?

5.2.2.1 Major motivators of FV consumption

Participants expressed high motivation to include FV in their diets, with three main themes emerging: tradition, pleasure and preferences, and health and well-being.

5.2.2.1.1 Tradition

A dominant and recurring theme was the role of FV in traditional dietary patterns for both Fijians of iTaukei and Indian descent. Participants of both ethnic communities identified fruits as common breakfast foods, snacks, and desserts, whilst vegetables were more likely to be eaten at meals. Within the iTaukei culture, vegetables, especially leafy greens, complemented preparations of root vegetables and either meat or fish. For the Indian community, a wide variety of vegetables were habitually consumed, particularly at breakfast and lunch when they are traditionally eaten in curries and served with roti. Traditional meals were described as particularly important at feast and festival times.

In Fijian [culture] it's like we can't go without vegetables. You know, Fijian... yeah, we can't go without vegetables... We use a lot of vegetables in Fijian dishes to fill our stomach. (iTaukei woman)

We can't keep eating meat without vegetables - there will also be green leafy vegetables cooked along with it. And the fruits are used in the morning, some mornings we have tea, mostly pawpaw. That's all. (iTaukei woman)

For some, religion also played a role in motivating FV intake. Hindu participants explained that within their religion it is typical to observe a vegetarian diet for several days each week and for extended periods surrounding religious functions. During these times, vegetables and legumes

are the foundation of the diet. Hindu participants also described using fruits as religious offerings and then consuming them following the ritual. The role of religion was cited also by some Muslim participants, who explained that during the holy month of Ramadan the fast is broken with fruits because, “*when we are hungry [for] the whole day, it is... lighter on the digestive system*” (Indian woman).

...Most of the time we Indian people we are vegetarian, so we depend on the fruits and the vegetables we can buy. Like sometimes our [Hindu religious] function comes for nine days, eight days so we [are] vegetarian for nine days, eight days. Sometimes [it lasts for] one month so we just stay on vegetables. So we just eat vegetables. We go marketing (shopping) for vegetables. (Indian woman)

...When we have prayers... that is when we offer the fruits to our Gods. So when we offer that and from that - the offerings - we usually take it. We eat the offering, all our fruits, all our fruits we get from the market. We offer all fruits... We are lucky for that. [Even] if we don't buy it at our home but still when we go elsewhere we get the fruit. We get the fruit we eat. (Indian woman)

Some participants described a visible shift in diets over their lifetimes. Several older participants discussed their preferences for traditional diets rich in local FV, whilst younger people were portrayed as more interested in processed and imported foods. For example, several parents described preferences amongst their children for fast foods like pizza, fish and chips, and burgers, rather than the traditional meals. Even with the FV food group, many young people were described as preferring imported fruits, such as apples and pears. Discussions indicated that traditional foods are still commonly consumed at home and continue to be highly valued for special events (e.g. family get-togethers) and holidays, but are now often combined with some imported or processed foods.

5.2.2.1.2 Health and wellbeing

Another strong, recurring theme surrounded the importance of FV to health and wellbeing.

Participants said health – broadly described – was a key benefit to consumption and participants

frequently referred to the FV food group and individual products as “healthy” and “nutritious”.

Overall FV consumption was considered to be a core component of living a healthy lifestyle.

They (FV) are essential for our life. (iTaukei woman)

It's healthy when you eat vegetables and sometimes it protects you from sickness.
(iTaukei woman)

FV were described as important for disease prevention and treatment of various illnesses. Some participants clearly understood and articulated the importance of FV to reduce risk of specific diseases, both micro-nutrient deficiencies (e.g. anemia) and diet-related NCDs (e.g. heart disease and diabetes), and maintain overall health. In addition to the food group at large, individual products were identified as beneficial for certain purposes and valued for this attribute. For example, participants from both major ethnic groups identified amaranthus as an iron-rich food and many reported habitual consumption of papaya as a digestive aid: “*It's good for the motion*” (iTaukei woman).

It's (amaranthus) very nutritious and, you know, it's like very good for an anaemic person. It's a source of iron there. (Indian woman)

I choose pawpaw because it helps me with metabolism every day. Yeah, every day.
(iTaukei woman)

Surprisingly, across the groups there was no discussion of a possible link between FV intake and weight management. In fact, reference to body image was mentioned only twice, both times by participants of Indian descent. However, participants acknowledged high rates of chronic disease in Fiji and several, especially in the iTaukei community, believed that this was strongly associated with a shift away from traditional diets rich in local FVs.

...[T]here is a lot of sickness today that is caused by what we eat: a lot of new food. If we just go back to these (local) foods, then all of these sickness will not be here. Now it is noticed that there is a lot of high blood pressure, diabetes... heart attack, kidney failure and lungs, this is simply because, we are not using, or not taking a lot of locally produced food, like the vegetables. We eat a lot of processed food from the shop. I would like say here that, this kind of food from the shop, is like emergency food, that is - meat, we eat a lot of it and we not eating vegetables or food from the garden... (iTaukei woman)

FV were also discussed in terms of concepts of well-being, especially children's well-being. Participants of both ethnicities expressed a strong motivation to provide their families with nutritious food that would nurture healthy growth and support proper development. For example, parents discussed the role of FV in helping their children stay happy, mentally and physically "fresh", and satiated throughout the day.

Especially our children - when they go to school... we have to buy some fruits for them to keep their mind fresh. (Indian woman)

Eating patterns were believed to be learned in childhood and maintained through the course of one's life. Participants from both ethnic groups shared the belief that parents have an important role in providing an appropriate example for their children and promoting healthy diets, which were described as those rich in FV – particularly local products – and low in oil. "Healthy" foods were often contrasted by participants with "junk" foods.

...Small kids - they are usually on junk foods. But it's all upon the mothers to teach the children at home. The type [of] vegetable and fruits you give them, they'll eat it. If you won't [give them fruits and vegetables or] if you just force them or just give them the junk foods, they'll just be trained on that. So it's better that we train our own children at home to have vegetables and fruits in their diet. (Indian woman)

Participants described several different sources of information on diet and health. iTaukei participants revealed that many local FV were used in their community as traditional medicines for protection or healing. These properties were perceived to be product-specific, for example, consumption of papaya flesh and seeds was thought to prevent disease and treat a range of ailments, including cough, gastric ulcers, and cancer. Older community members are respected as the best source of information on the use of FV for this purpose and traditional knowledge is passed down from generation to generation. Many different sources of more contemporary health information were mentioned also, with doctors, dieticians, and the Ministry of Health being highly regarded. Schools were another source of information for some, with lessons learned in classes remaining influential into adulthood. For example, one older participant shared a poem

that she learned in a Hindi vernacular class in primary school and had remembered for over fifty years: “*Doodh piyo aur gajaar khao daatho ko majbooth banao*”, which translates to “*Drink milk and eat carrot for strong teeth*” (Indian woman). Friends and family, particularly those overseas, also were cited as sources of information on the healthy properties of different foods and diet patterns.

Most of our fruits are herbal too, if you know about it. Old people will tell us, “that’s for this, that’s for that.” (iTaukei woman)

Early in the morning when my husband wakes up, I just cut the fruits and give the fruits to him and we eat too. And after one hour then we have the breakfast because fruits we have to eat first. Fruits got acid. Acid goes inside first. If we will eat food first, the food will go inside then the acid will damage all the food... My brother came from Canada and he said first [to] eat the fruit, then eat the [other] food after one hour because... the acid of the fruits make the food gets waste. All the thing (nutrients) goes out. Nothing comes in your body. (Indian woman)

Although FV were perceived by participants as beneficial to health, some expressed concern about negative health consequences associated with consumption of highly acidic products (e.g. tomatoes) or FV contaminated with pesticides. Concern over food safety linked to improper use of agro-chemicals was raised by both major ethnic groups and was particularly pronounced for amaranthus. Fear of an adverse effect from consumption of contaminated leaves was linked to a recent public health scare (see Section 5.2.2.3.1), stories from friends, and personal experiences.

Chauraiya (amaranthus) is not my favourite. Sometimes I eat and sometimes I don’t have to eat because I’ve noticed that most of the farmers they are using a lot of chemical on chauraiya, aih? And once I bought it from the market and brought it [home]. We could smell the chemical - maybe para[quat]. A day before they used the chemical, you know. I can smell the orthene, chemical smell. So from that time I refused to eat chauraiya, you know. Before, it used to be my favourite. From that time, sometimes I ignore to eat, just like because of that smell part came. (Indian man)

5.2.2.1.3 Pleasure and preferences

In all the focus groups, personal preferences emerged as a strong influence on what participants chose to consume. Participants talked about foods that they like and foods that they do not like,

using non-specific descriptive terms such as “good”, “nice”, “lovely”, or “tasty” to express why they seek out preferred foods.

Sometimes it's like when you crave for a certain food - you want that certain vegetable to be there so that's what actually makes you go and buy it. (iTaukei woman)

Family enjoyment was an important determinant. Participants described selecting and preparing foods that they felt confident their family – particularly children – would enjoy and some reported paying higher prices to buy products that matched their family's preferences. FV were used to increase the dietary variety and attractiveness of meals by adding colour and flavour. Some parents expressed a conflict between a desire to provide adequate FV and feed their children foods they liked.

...Some vegetables which are very favourite to our children - we cook that one too so that they eat well. Sometimes if they don't like it, they don't eat well. And then we have to combine and give them some other kinds of food, like cereal, Weetabix... so that their stomachs are full when they go out to school. (Indian woman)

...For myself, I usually buy lettuce as well to go, because it's green and usually goes with all the foods and if we make dhal we can make salad and put the lettuce there. So as to make our food look green and [we] know the kids can see the variety there and colour and they can eat. (Indian woman)

5.2.2.2 FV attributes valued by urban Fijians

The major motivators for FV consumption described above obviously influence how participants decide the value or quality of products. Four main dimensions of quality emerged from the focus groups as important to participants: taste and appearance, perceived health benefit, freshness, and convenience. The first two of these dimensions were outlined above: taste and appearance are central to the hedonic experience of eating (Section 5.2.2.1.3) and a product's health-oriented value is related to how a consumer perceives consumption of that product will affect his or her health (Section 5.2.2.1.2). In this sub-section, participants' thoughts on freshness and convenience are described. Multiple overlaps existed between the four quality dimensions and

they were considered complementary rather than independent. Even when available and affordable, participants reported passing on FV that did not meet their criteria for quality.

5.2.2.2.1 Freshness

Freshness was a key attribute demanded by participants across the focus groups. For participants, the term described both unprocessed FV and raw FV that were newly harvested and did not yet exhibit signs of post-harvest deterioration. Freshness was important for all exemplar products and was closely linked for participants to enhanced eating pleasure and greater perceived health benefit. “Fresh” was often equated with the words “nice”, “healthy”, and “good”.

We love to eat green vegetables, fresh and green vegetables, because they are very nutritious too us. (iTaukei woman)

Tomato is a healthy vegetable, but it is best to eat it raw. Cooking makes it lose freshness. (iTaukei woman)

5.2.2.2.2 Convenience

Many participants reported convenience to be an important consideration in their FV choice and described three dimensions: convenient acquisition, product versatility, and time-saving preparation techniques. To save time and money on transport, many participants preferred to limit their major market shopping to weekends and thus described a value to FV that could be kept for several days without “going off”. Supplemental commercial and subsistence approaches were used mid-week to acquire FV. Purchasing FV from door-to-door vendors, roadside stalls, or mini-markets was common for this purpose. Although door-to-door vendors offered a narrow range of products and were sometimes viewed as unreliable, their service was valued as convenient and low-cost. For example, one iTaukei woman explained that she liked to buy from door-to-door vendors because she was too “*lazy to go into town*”.

Major subsistence approaches of FV acquisition included home production, sharing, and gifting. Many participants – particularly those who live in peri-urban settlements – described maintaining small-scale homestead FV gardens and sharing harvests with friends and family as a strategy for

reducing dependence on markets and saving money. According to participants, Indian gardens commonly contain a range of FV, including eggplant, chilli, amaranthus, and papaya, while iTaukei plots were more likely to include tubers and their greens, specifically taro and cassava, as well as bele. In addition, several iTaukei participants described the important dietary contribution of fruits, vegetables, and root crops given as gifts by visitors from their native villages.

[Cassava leaves are] easy to prepare for our meals, because we just plant the cassava plant and, when it grows, us we just pick the soft cassava leaves and pull the whole tree and we cook. We cook the cassava together with the cassava leaves, mixed with lolo (cooked coconut milk) and some fish in it, because we eat it together. It's easy for us. That's why I choose cassava, because my husband and the boys at home they plant cassava. We've got a little piece of land outside from our housing land - it's for the government but we're using that for planting cassava. That's why we choose - it's easy... and when we haven't got the money we just go to the plantation and pull the cassava plant and the leaves and we cook it and prepare for dinner or for lunch... (iTaukei woman)

Versatility was considered another desirable product quality, as participants felt it was important that they could make a variety of meals with a limited number of products. FV that could be consumed in multiple ways (e.g. raw, as ingredients in dishes) were viewed as “useful”. All three exemplar products were lauded by participants for this attribute.

One thing you see with chauraiya (amaranthus), there are... I mean we can do a lot of things from it. Mostly I just stir fry it or just boil it or even we just sometimes cook with baigan (eggplant) and tomatoes. So those are some ways that [we prepare it]. But chauraiya, if you cook any way, like it's already delicious on its own... (Indian man)

We can use pawpaw (papaya) in lots of ways... we can use the matured ones for curry, with fish, the ripe ones for lote (pudding). We can eat it whole, [in] salad, [or as] juice. We use [it] for pawpaw fruit juice. (iTaukei woman)

I choose [to eat] tomato because it's my favourite and I can make a lot of dish with tomato. [For] example, like I can make pizza with the tomato, chutneys, and I can use for like a dish [with] like cabbage and moca (amaranthus) to mix in with it. And it's healthy. (iTaukei woman)

Because participants spent a considerable amount of time cooking each day, they appreciated products that required little or no preparation. FV that could be consumed raw (e.g. apples,

carrots) were considered convenient and appealing snacks and often were offered to children at home and packed in school lunches. Of the exemplar products, participants said they often ate papaya and tomatoes raw; however, amaranthus leaves needed to be cooked or fried in oil. Despite being described as “easy to cook”, amaranthus was seen as *“hard to clean... because every leaf you have to see the backside because sometimes the insects [are] there”* (Indian woman).

There was high interest amongst participants in minimally processed fresh FV despite few such options currently being available in Fiji. For example, participants in several groups said they wished they could buy carrot sticks – described by one woman of Indian descent as an *“anyone, anytime, anywhere”* food – or grated carrots to save time in food preparation. However, there was no discussion on how processing of fresh FV could affect price and how higher prices would influence demand.

...[I]f there's a factory to prepare the grated one (carrot) and pack it in a nice container, [a] nice pack, and put it in the deep (freezer), I think we do have to buy that. It's easy... Maybe if it's going to be like that then everybody [will] run for the grated carrot, [because it] saves time. (iTaukei woman)

5.2.2.3 Characteristics which signal value/quality

Across the exemplar FV, the appearance of freshness and ripeness were the major attributes that participants associated with value, as they were considered indicators of health benefit, eating pleasure, and convenience. This section presents how those attributes are decided on by consumers and is divided into four sub-sections. The first sub-section examines quality cues that are ‘extrinsic’ to products, including product origin, properties of the retailer, and the unit of sale.² The other three sub-sections discuss the intrinsic characteristics of the three exemplar products on which participants base their value assessments, such as the way products look, smell, and feel.

² Intrinsic characteristics refer to the physical features or technical specifications of a product. Extrinsic characteristics are all other features.

5.2.2.3.1 Extrinsic characteristics

For a subset of participants, buying Fijian-grown produce was important, and product origin was associated with taste, freshness, and health properties. For these persons, Fijian-grown FV were considered to be more trusted than imported products, with greater knowledge of local production practices and value chains given as a reason. Some participants also viewed purchasing local products as a way to contribute to the Fijian economy, i.e. “*spend the money inside*” (Indian woman).

It's because we've been consuming fruits at early age. So if we don't have fruits it's, you know, not right. Because we're used to having local fruits and even though they are seasonal, you know, we'll go out and get them from the market or from roadside stalls. So yes, fruit is part of our lives; I mean local fruits is part of our lives, not overseas fruits. And they're cheap and readily available, fresh. And that's it. (iTaukei woman)

I believe that we can grow our own carrots. I know that for sure. We never know what chemicals they use to grow them overseas, so it's better to plant our own. (iTaukei woman)

Some participants perceived a benefit to buying FV “straight from the farmer” and “avoiding middlemen”, which were considered to be linked with increased affordability and freshness, as well as reduced risk of contamination from pesticide residues. As described in Section 5.2.2.1.2, several groups discussed concerns about food safety linked to improper use of agro-chemicals by both farmers and retailers. In one focus group with Fijians of Indian descent, participants referred to a specific incident when pesticides had been used illegally by vendors and said this incident had influenced their decision to buy amaranthus from their neighbours rather than market vendors:

Woman 1: *Why I don't like chauraiya? Because we have to put too much manure (fertilisers) and [we have] to spray it for the insects. When I buy, one man, my neighbour, he brings chauraiya [door-to-door] for FJ\$1... I ask him “When did you spray?” [and] he says “One week ago”. Once in a week he brings it. I ask him again on when he sprayed the chemicals. But, whenever I bring the vegetables from the market, I keep it for three or four days, like that, then I start to cooking, because if anything chemical like that.*

Woman 2: *No, because about two years ago some people (market vendors) were keeping that orthene in the basin and mix with water and they used to dip chauraiya in that and sell it right. So they were caught. So we are a bit afraid to buy from the market at the moment.*

Affirmative sounds from other participants.

Moderator: *So where do you normally buy your chauraiya from?*

Woman 2: *[I buy from people] in the village... the people we know. They won't do it like that, eh? Because normally people put manure or orthene just one week before [harvest]. And these market people, they wanted to keep [it] and show that it's fresh and the dark green colour, [so] they dip[ped it] in urea and water. So they were caught. I mostly buy from my village.*

Despite this, consumption of imported fresh produce on a daily or weekly basis was nearly ubiquitous amongst participants from both urban and peri-urban settlements. In all groups, examples were offered of imported FV that were consumed regularly (e.g. carrots, onion, apples). Some participants explicitly noted that product origin does not factor into their product selection, as decisions are dominated by considerations of price, preferences, and perceived freshness.

I don't really know the difference with the local ones (carrots) and the overseas ones. I just go - whatever is there, that's it, I have to buy it. I don't really know what's the difference, and I'm not really bothered too to ask whether it's local or overseas as long as they have whatever I want. (iTaukei woman)

The atmosphere created by a retailer was used by some participants to signal quality. A pleasing atmosphere was described as involving both product presentation and personal presentation (e.g. “*how they groom themselves, the way they dress up*” (iTaukei woman)), which were associated with the pleasantness of the shopping experience and healthfulness of the products.

Like when you see rubbish laying carelessly - you know, at the vendor's [stall] - I don't buy from [them]. And if I see flies and stuff like that... and when they put it on the floor - some spread it on the concrete floor, eh? But they [should] put something on top of it, because it's unhygienic, when the dust... Especially outside of the market, they sell it there and on the roadside. But some sell it on top of the table. That's where we go. On top of the table inside the market or outside, even outside, they have tables there. Yeah it's much more clean, eh? (iTaukei woman)

For some participants, the unit of sale in which a product was offered was an indicator of value for money. A preference for FV sold by weight (rather than in piles) was related to the ability to self-select, thus ensuring purchase of only those products that were fresh and appealing. For example, one iTaukei woman described her frustration with market vendors burying “bad” FV in heaps and said that this led her to prefer shopping at the supermarket where “*you handpick. You choose what you want.*” Other participants expressed a contrary view (i.e. a preference for buying FV sold in heaps), which was described as a familiar unit and cheaper. Regardless of unit of sale, participants were concerned with volume offered for a given price and preferred greater volumes. For example, large bundles of amaranthus were favoured over “thin” bundles because they were more likely to be enough for a meal.

5.2.2.3.2 Amaranthus

During specific discussion of amaranthus quality, participants focused on five important product characteristics: leaf size, colour, visible flowers, withering, and the presence of insects and/or insect holes. The first characteristic that participants distinguished was between small leaves (sometimes called ‘baby’ or ‘young’ amaranthus and typically harvested and sold with the roots attached) and large leaves (sometimes called ‘old’ and sold without the root structure). Amongst all focus groups, leaf size was used as a proxy to indicate attributes of taste, texture, and cooking convenience. With few exceptions, participants of Indian descent preferred the small leaves, which were popular with many iTaukei participants as well. A subset of iTaukei participants favoured the large leaves. Choice of leaf size appears to be a personal preference and linked to planned cooking method. Participants described how the “soft” texture of small leaves is well suited for traditional Indian cooking involving quick pan frying, whilst the “stronger” texture of large leaves lends itself to boiling in soups and stews common in iTaukei cooking. Large leaves were seen by some as an economical option as they were sold more cheaply.

Small leaves ones - that one is tastier than the bigger ones. And when we pick chauraiya, when we shake [and] the leaves always fall, that means that's the old one. We just go for the fresh ones. (Indian woman)

[W]hen it comes to tubua, I get to do the cooking. So we normally just go for the fresh ones that has big leaves too, because you have more in it, rather than just buying a small bunch... (iTaukei woman)

Participants also looked for signs of perceived freshness in bundles. Freshness was indicated by bright green leaves that did not appear wilted or have visible flowers.

...[I want] the ones that are very green - not the ones that are withered - the ones that are still green [and] look good. If we also go to the market you can see the ones like that that are very fresh. (iTaukei woman)

...When I choose tubua I don't like to see what we call in Fijian "sena" - that's the flower. I don't normally buy that, because when you eat it with that flower it tastes... It gives that sour taste. (iTaukei woman)

Across the focus groups, participants expressed differing perspectives on visible insect holes, and how noticing holes affected their choice depended on whether health concerns, time pressures, or aesthetics were more important considerations. Some said that they seek out leaves without holes because they view the holes as product damage and removing insects from the leaves is arduous; whereas others said they look for leaves with insect holes because they are perceived to be *"the healthier one, without the chemicals"* (iTaukei woman).

5.2.2.3.3 Papaya

During specific discussion of papaya quality, participants focused on shape, colour, firmness, and ripeness. Participants described distinguishing between papaya varieties based on shape. Across both ethnic groups, consumers preferred fruits of the 'Hawaiian variety' due to their perceived sweeter taste. This variety was considered most suitable for raw consumption, while other local varieties were often used unripe in savory dishes.

We buy from the market the smaller ones which is called Hawaiian pawpaw. It's sweet to eat. And the bigger ones we don't usually like to eat because it's not that sweet. So

make the curry from this and we usually buy the fruit to eat from the market. (Indian woman)

Across all focus groups, consumers discussed how fruit colour and firmness were used to infer ripeness, which itself was considered an indicator of flavour and convenience. Many participants described making planned purchases of papaya displaying varying degrees of ripeness so as to spread out consumption, with new fruit reaching peak ripeness over several days. For this reason, half-ripe, yellow-coloured papayas were often sought.

Actually, if I am going to buy pawpaw for the family for the weekend... I will look for something like what she says - Not really yellow or ripe but a bit half ripe, just enough – by tomorrow I will be able to eat it. You know what I mean? So if I need it for the whole week, then I'll get something a little bit green, a little bit yellow... so as each day go, you know it'll be ripe... (iTaukei woman)

5.2.2.3.4 Tomatoes

For tomatoes, participants reported basing quality or value assessments primarily on appearance and firmness. Participants agreed that firm, red fruits, free of black spots and blemishes were ideal. Firmness and colour were used to indicate ripeness. As with papaya, ripe fruit was believed to signal superior taste, while unripe fruits were valued for their flexibility to be used incrementally over several days. Further, several participants indicated that a bright red shade was valued for adding colour to meals. There was no agreement in the groups regarding preference for size.

The outer part of the tomato skin – that's the [main thing. It] makes us [see] that it's the good one, without any spot or black spots... just very clear and nice looking. (Indian man)

We buy unripe ones too so that we can store it for long periods of time. And as it gets ripe we eat as it comes. We eat the ripe ones first and then unripe one we can just eat it later when it gets ripe. We can just put it outside the fridge. (Indian woman)

Whenever I have tomatoes in my house, whenever I cook like dhal, any kind of vegetable, I make sure that I put it there. It looks nice because the red colour shows out and it tastes good. (Indian woman)

5.3 Conclusion

Participants were positive about consuming FV as part of their diets, particularly fresh, local FV. Both ethnic groups discussed tradition, health and well-being, and pleasure and preferences as important motivators to include FV in the diet. However, the local supply was often perceived to be unpredictable, unaffordable, and sometimes of poor quality. These sentiments and concerns were consistent across ethnic groups, although preferred products and preparation techniques differed. The discussions also highlighted changing dietary patterns, with imported and processed foods increasingly being incorporated into meals and diets.

The interrelated factors of availability and price were identified as key constraints on FV intake. Most participants were highly price-sensitive, but also cared about quality and sought out products that they perceived to be value for money. Even if products were reasonably priced, if they were not of good quality, participants would not buy them. Quality was defined by participants primarily in terms of freshness, taste and appearance, healthy properties, and convenience. Although the characteristics that consumers used to signal quality differed from product to product, these attributes usually were inferred from the appearance (e.g. colour, size) and physical feel of the product, and the characteristics of the seller (e.g. perceived trustworthiness, cleanliness of facilities).

These findings compare well with FV attributes found to be important to consumers in other developing country studies (Adhikari et al., 2012; Ali, Kapoor, & Moorthy, 2010; Macharia et al., 2013) and will be discussed in more detail in Chapter Nine along with the findings from the value chain analysis. Urban consumers in Fiji have strong economic constraints, meaning that any efforts to optimise value for consumers must consider final retail price. In most instances, the characteristics valued by consumers can only be achieved through a whole-of-chain approach, as delivering attributes such as freshness and food safety require collaboration between actors.

These findings, therefore, can be useful in informing a value chain analysis of the FV sector, presented in the next three chapters.

CHAPTER SIX: STRUCTURE AND ORGANISATION OF THREE EXEMPLAR FRUIT AND VEGETABLE VALUE CHAINS

6.1.Introduction

The previous chapter described consumers' motivations for consuming FV and the dimensions of consumer-defined value for amaranthus, tomatoes, and papaya. The following three chapters draw on analysis of primary data collected from mapping workshops, key informant interviews, and observations across three exemplar chains. Together, they address the basic structure of the exemplar chains, the three conceptual dimensions of the strategic-management model of value chain analysis (material flow, information flow, and relationships), and vulnerability in the sector.

This chapter begins by providing a basic overview of the structure of fresh FV marketing in Suva, Nausori, and the connecting corridor (Section 6.2). Following this, the selection of the three exemplar chains is outlined, and a basic description on how those chains are organised and the major activities involved is provided. Each exemplar chain is presented in its own section (Sections 6.3-6.5). A brief conclusion is provided in Section 6.6. Explanation of why the chains are structured and function as they do is reserved for Chapters Seven and Eight.

6.2.Basic structure of fresh FV marketing in Suva-Nausori

The local municipal councils of Suva and Nausori each operate a major fresh food market and, along with the Nasinu Town Council, have established several 'mini-markets' in the suburban areas along the Suva-Nausori corridor. Additional FV marketing is carried out by door-to-door vendors, at informal roadside stalls, and through supermarkets. Within the markets, goods are mainly sold from wooden or concrete tables. At the Suva Municipal Market and at several of the mini-markets, the ground outside is also marked off for selling. All market vendors (indoor and outdoor) pay a stall fee in relation to space occupied. Local FV are kept at stalls in ambient

conditions until sold or discarded; storage facilities (refrigerated or non-refrigerated) are not available. Fridays and Saturdays are the dominant trading days – both in terms of number of vendors and volume of FV available. The major municipal markets are closed on Sundays.

There are two main types of fresh FV vendors at the market: vendors who do not grow the FV they sell ('market middlemen') and farmers who sell their own produce ('farmer-cum-vendor' or 'producer vendor'). Market middlemen purchase their stocks at wholesale prices and then resell to urban consumers (and, sometimes, other vendors or restaurant buyers) with a mark-up. They typically retail FV six days a week and usually occupy several contiguous stalls in the indoor section of the market. Farmer-cum-vendors tend to occupy just one or a small number of stalls and can sell on a regular or irregular basis. Producer vendors that sell regularly tend to live in the peri-urban area and split farming and retailing responsibilities with other family members. Those that sell irregularly only come to the market when they have goods to sell. At the Suva Municipal Market, the outdoor selling area is open only on Thursdays, Fridays, and Saturdays and primarily accommodates producer vendors. All vendors deal in cash.

Most FV wholesaling takes place within designated wholesaling areas near the major Suva and Nausori markets beginning around midnight and continuing until the market opens. In Nausori, FV wholesaling is carried out at the edge of the market. In Suva, the wholesaling area was formerly adjacent to the market, but during the fieldwork was relocated to a car park about one city block away to accommodate changes to city planning. There are two types of wholesale sellers: farmers and 'rural middlemen'. Rural middlemen³ are those who purchase FV from farmers in rural areas and then sell-on the stock for higher prices. They can be producers themselves or simply service providers.

³ General use of the term 'middleman' designates any economic actor in the chain who purchases FV and then sells it on to others. This includes both rural middlemen and market middlemen.

FV are grown throughout Fiji, however, the most important growing areas for the Suva and Nausori markets are the Sigatoka Valley (approximately 100 miles from Suva) and the peri-urban periphery. Most FV is transported from nearby areas in open-top pick-up trucks, vans, or buses. From the Sigatoka Valley, three and four tonne open-top trucks are most common.

6.3.Amaranthus exemplar value chain

6.3.1. Selection of amaranthus exemplar chains

Government stakeholders who participated in the basic systems mapping workshop identified the peri-urban region around and between Suva and Nausori to be the site of most amaranthus production for the urban target market. Production was described to be dominated by small family farmers, with the help of hired labourers. Some of these farm families retail their own produce, while others wholesale their crop to either rural or market middlemen. The main functions, actors, and supporting institutions involved with supplying amaranthus to the Suva-Nausori market are presented in Figure 7.

AMARANTHUS

<u>FUNCTIONS</u>	<u>ACTORS</u>
Prepare farm	Peri-urban farm families, paid labourers, home gardeners, institutions (e.g. schools)
Produce and harvest amaranthus	Peri-urban farm families, paid labourers, households, institutions
Transport to market	Peri-urban farm families, paid labourers, rural middlemen
Sell to retailer (optional)	Peri-urban farm families; paid labourers; rural middlemen
Sell to final consumer	Market, road-side, and door-to-door vendors; eating-out establishments; supermarkets; institutions

<u>SUPPORTING INSTITUTIONS</u>
Donors (e.g. external funders who support research and road works), financiers (banks and microfinance organisations), national government (including Department of Agriculture, Ministry of Health, and Ministry of Rural and Maritime Development and National Disaster Management), local town councils, agro-input suppliers

Figure 7. Main functions, actors, and supporting institutions in the amaranthus supply to Suva-Nausori

Data sources: Basic systems mapping workshop, detailed chain mapping workshops, interviews, and observations

In the basic systems mapping workshop, the participants suggested three possible amaranthus chains to be the subject of detailed investigation (Figure 8). The first suggestion was the subsistence chain in which urban and peri-urban home gardeners produce amaranthus for home consumption. The second and third suggestions were commercial chains in which amaranthus is sold through markets or by door-to door vendors. Due to the likely similarities between the actors involved in the two suggested commercial chains and the importance of both market and door-to-door sales to consumers (as determined from the consumer research), a decision was taken to consider them together as the exemplar.

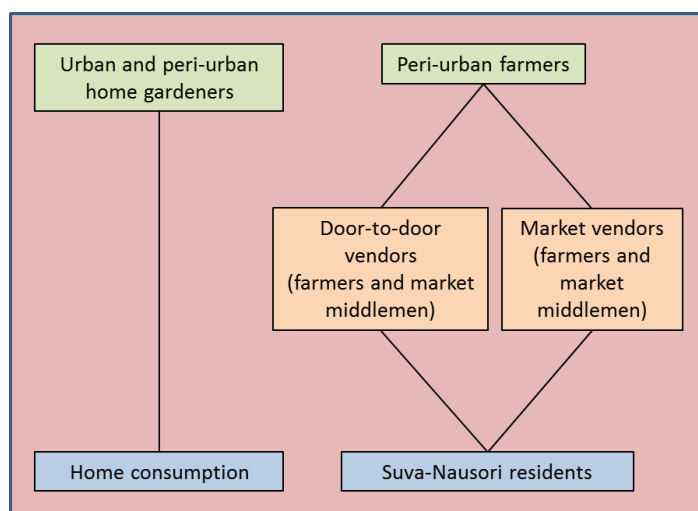


Figure 8. Amaranthus chains suggested by government stakeholders as possible exemplars, based on their perceived potential to increase consumption amongst Suva-Nausori residents
Data source: Basic systems mapping workshop

6.3.2. Basic structure of the amaranthus exemplar chains

Amongst peri-urban farmers, amaranthus is a popular crop due to being quick and relatively easy to grow, and generating a consistent income stream through year-round production. In addition to amaranthus, peri-urban farmers often grow bele, Chinese cabbage, English cabbage, taro (for the root and leaves), coriander, eggplant, and chilli (see Table 1, p. 44 for Latin names). Due to their proximity to local markets, they have an advantage in the production and sale of highly perishable products (e.g. leafy green vegetables) over growers in more remote areas. Increasingly, peri-urban farmers are choosing to grow ginger due to high perceived demand for both fresh and candied ginger by exporters.

Our land is very small too, that's why we want to plant chauraiya bhaji (amaranthus)... Because [if] we got bigger land, then we can plant dalo (taro root) because it takes one year [to grow]... We got small land - that's why we have to cover [it with] small things and harvest very fast... [and] it's easier for us. (Amaranthus farmer)

I believe, just from the market side, the farmers they are looking at what the economy is like for the whole country. They can't be planting chauraiya all the time when ginger is in demand, you know? So they'll have to switch and maybe due to the switch, the production is less. That's why we are having less supply and the price is high. Supply and demand, eh? (Amaranthus vendor)

The major material flow processes in the exemplar amaranthus chain are presented in Figure 9. Amaranthus usually is grown on multiple small plots simultaneously, with staged planting to support continual harvesting. Farmers collect seeds from their own crop and use one of three approaches to plant: reseeding; gathering seeds from a matured crop and broadcasting to a cleared plot; or transplanting young plants from a crowded plot to a cleared plot. According to farmers, choice of approach depends on recent use of the plot, the perceived condition of the soil, and personal preference, i.e. “*everybody’s own techniques*” (Amaranthus farmer). When a cleared plot is used, existing plants are removed and the soil is disturbed prior to planting. Production is labour-intensive and growers typically rely on simple tools.

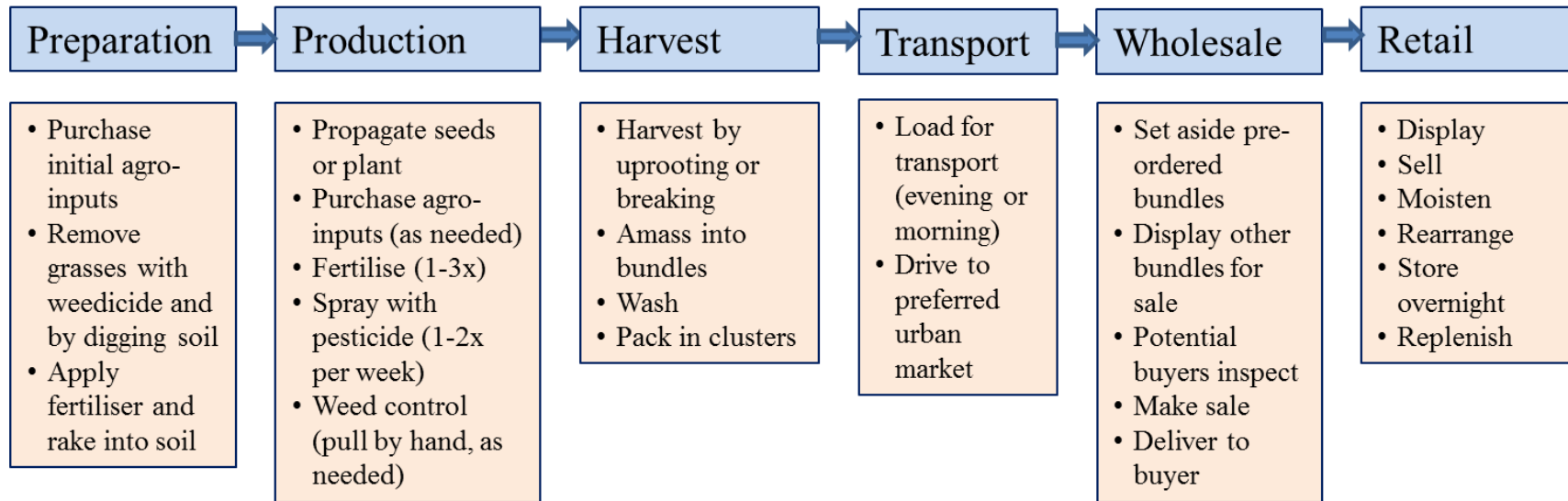


Figure 9. Material flow processes in the exemplar amaranthus chain
 Data sources: Detailed chain mapping workshop, interviews, and observations

Commercial amaranthus production in the Suva-Nausori corridor is heavily dependent on agro-chemicals and poultry manure. If herbicide is used, it is applied during land preparation.

Farmers fertilise with poultry manure, urea, and, to a lesser extent, NPK, with what appears to be particularly high and variable levels of fertilisation with poultry manure. Starting approximately two weeks after planting, pesticides are used one to two times per week to control insects.

Growers purchase agro-chemicals from input supply shops and manure from commercial poultry producers.

Harvesting begins about three weeks after planting and can extend for several months. There are two methods of harvesting: uprooting a young plant or snapping the tender upper portion off of a mature plant. Uprooting is pursued only when the plant is small and uprooted amaranthus often is referred to as the 'baby' or 'young' type. Alternatively, leaves can be snapped off matured plants repeatedly over several months. Amaranthus harvested in this way is frequently called the 'big' or 'large leaf' type. Some farmers said they focused on growing one type or the other, but many reported harvesting both. With either approach, several stems are amassed into a bundle and tied together. Bundles are then washed to remove soil and insects. Most farmers consider only local markets and door-to-door sales as possible retail channels for amaranthus, although a small subset reported selling to exporters or supermarkets.

Farmers or rural middlemen transport amaranthus to market at night or in the morning. Those who sell at the wholesale market typically arrive before dawn and offer bundles by the dozen or half dozen. When a transaction is completed, bundles are transported by the seller or a hired wheelbarrow operator to a location specified by the buyer. Farmers who do not sell at the wholesale market (e.g. those with their own stalls or who sell entirely based on pre-orders) bring their amaranthus to the market later in the morning.

At the market, bundles are displayed for consumers in piles. When saleable bundles remain at market closure, vendors give them away, sell them outside the market, or store them for the next day. After a second day, bundles are no longer considered saleable.

Door-to-door sellers produce their own amaranthus or buy it from farmers or middlemen. They normally confine themselves to a small geographic area (e.g. a neighbourhood or village) and walk or cycle from house to house. Door-to-door sales continue until amaranthus and all other FV being carried by the vendor are sold or no other buyers can be identified. Amaranthus deemed unsaleable is thrown away or given to a local swine farmer as livestock food.

6.4.Papaya exemplar value chain

6.4.1. Selection of papaya exemplar chain

Government stakeholders who took part in the basic systems mapping workshop identified the Sigatoka Valley to be the most important commercial growing region for papaya. The export industry was considered a critical participant in both local and export value chains, with most papaya growers believed to produce the fruit with the intention of export and to send extra or rejected fruit to the local market. Farmers and rural middlemen were said to transport papaya to Suva for retail through a range of different outlets. In addition to Government ministries, organisations involved in the export industry were considered important supporting institutions. These include the Taiwan Technical Mission – a research and advisory organisation based in Sigatoka which is run and funded by the Republic of China and closely partnered with Department of Agriculture – and Nature’s Way Cooperative – an industry-owned cooperative responsible for undertaking mandatory quarantine treatment of fruit fly hosts (including papaya) prior to export, but which also provides marketing and technical services to growers. The major functions, actors, and supporting institutions in the papaya supply to Suva-Nausori are shown in Figure 10.

PAPAYA

<u>FUNCTIONS</u>	<u>ACTORS</u>
Prepare farm	Sigatoka farm families, paid labourers, home gardeners, institutions (e.g. schools)
Produce and harvest papaya	Sigatoka farm families, paid labourers, home gardeners, institutions (e.g. schools)
Identify market	Sigatoka farm families
Sell to rural middleman or exporter (optional)	Sigatoka farm families
Transport to market	Sigatoka farm families, paid labourers, rural middlemen
Sell to retailer	Sigatoka farm families, paid labourers, rural middlemen
Sell to final consumer	Market and road-side vendors; eating-out establishments; supermarkets; small shops; institutions

SUPPORTING INSTITUTIONS

Donors (e.g. external funders who support research and road works), financiers (banks and microfinance organisations), national government (including Department of Agriculture, Ministry of Health, and Ministry of Rural and Maritime Development and National Disaster Management), local town councils, agro-input suppliers, Agro-marketing Authority, Taiwan Technical Mission, Nacocolevu School

Figure 10. Main functions, actors and supporting institutions in the papaya supply to Suva-Nausori

Data sources: Basic systems mapping workshop, detailed chain mapping workshop, interviews, and observations

Participants of the basic systems mapping workshop suggested four papaya chains as possible exemplars (Figure 11). The first suggestion was the chain involving production in the Sigatoka Valley and sales at Suva-Nausori supermarkets. The second was the chain which encompasses production in the Sigatoka Valley and sales at urban markets. The third and fourth suggestions were the chains that pass through informal roadside stalls, with supplies coming from either home gardens or the Sigatoka Valley. The chain passing from Sigatoka farmers through market middlemen (both those who wholesale and retail and those who exclusively retail) was selected to be the exemplar, as urban residents who took part in the consumer research reported markets to be the most important source of papaya.

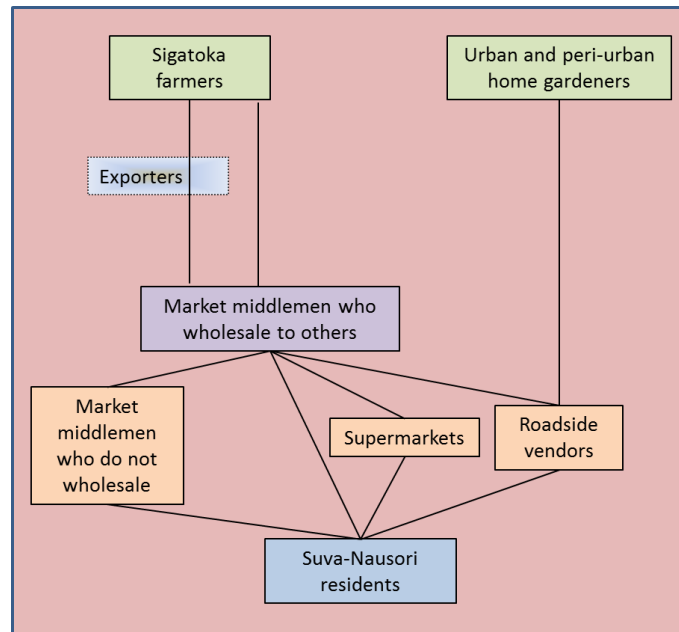


Figure 11. Papaya chains suggested by government stakeholders as possible exemplars, based on their perceived potential to increase consumption amongst Suva-Nausori residents
Data source: Basic systems mapping workshop

6.4.2. Basic structure of chain

Farmers in the Sigatoka Valley (hereafter referred to as ‘Sigatoka farmers’) generally grow a range of FV for sale, including papaya, tomato, eggplant, okra, long bean, green bean, Chinese cabbage, English cabbage, and pumpkin (see Table 1, p. 44 for Latin names). Papaya usually is produced commercially in large monoculture blocks; however, during its early growth stages (before fruiting) farmers sometimes intercrop it with other cash crops to help maintain a flow of cash to the business. Papaya is a popular crop amongst Sigatoka farmers because it produces fruit year-round, can be harvested continually, and is considered highly profitable when sold to export markets.

I see more profit in papaya. [I] just have to plant it one year and, for the next three years, [I] only have to harvest it. Not too much work involved in that, just to harvest and sell, and put manure... (Papaya and tomato farmer-cum-rural middleman)

The main material flow processes in the exemplar papaya chain are presented in Figure 12.

Papaya seedlings are purchased from the Department of Agriculture, Taiwan Technical Mission,

or small independent nurseries (usually supported by Nature's Way Cooperative). The Department of Agriculture tends to be the preferred supplier, as its seedling prices are subsidized (about FJ\$0.43 each compared to around FJ\$0.50 from the Taiwan Technical Mission and independent nurseries) and it adds two to three seeds per pot (rather than one). The reason for planting multiple seeds per pot is to increase the chances of a viable hermaphrodite plant, as only fruits from hermaphrodites are accepted for export. If more than one seedling survives from a single pot, farmers can remove the females after the plants flower and the sex can be distinguished.

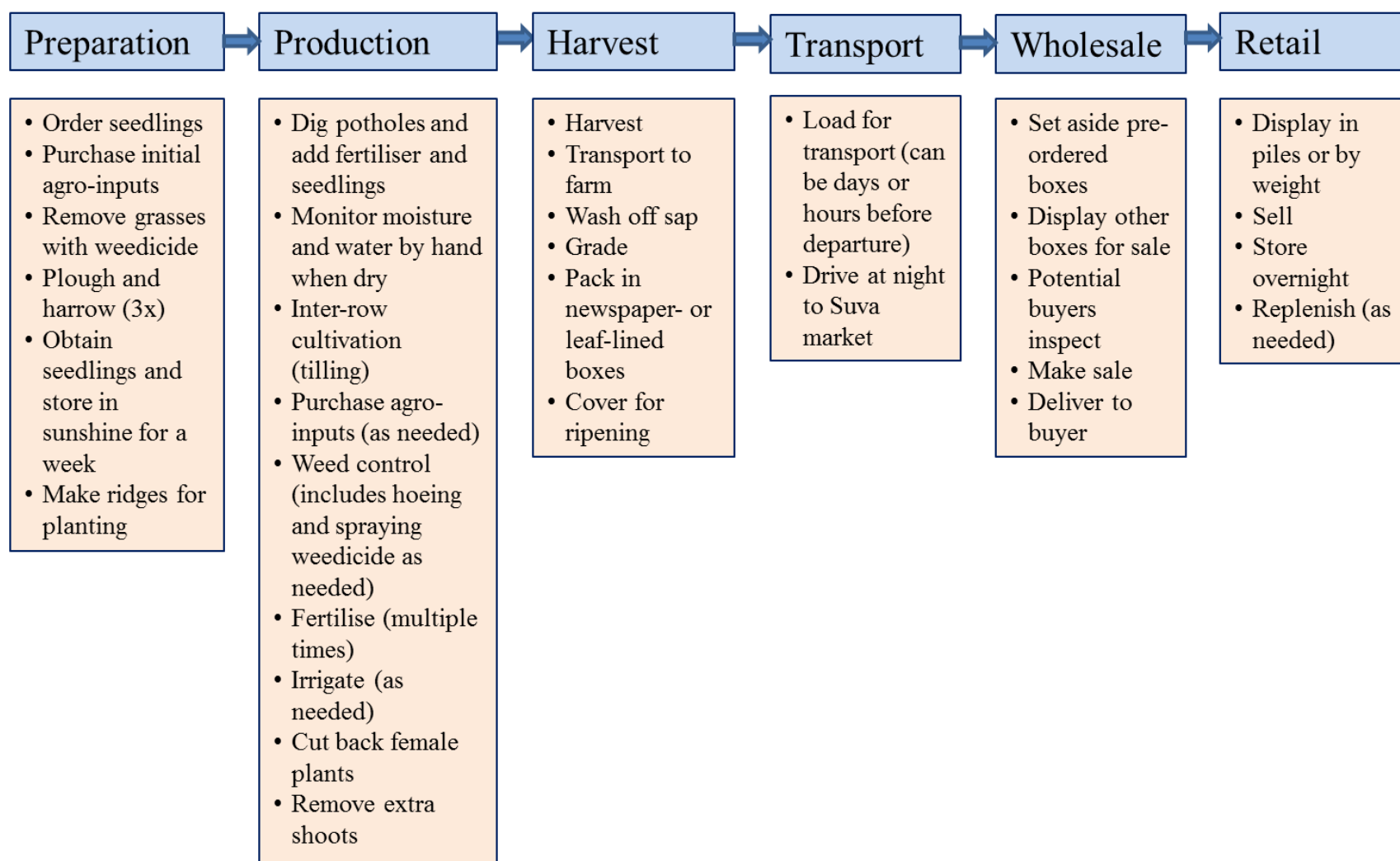


Figure 12. Material flow processes in the exemplar papaya chain
 Data sources: Detailed chain mapping workshop, interviews, and observations

Farmers spend several months preparing their land for papaya production by applying herbicide and ploughing and harrowing multiple times using a tractor, horse, or bullock. During planting, farmers add fertiliser (NPK or poultry manure) to the planting hole, and in the days immediately following planting, they carefully monitor moisture and hand water to improve the seedlings' chances of survival. Once plants are established (one to two months after planting), farmers control weeds with herbicides and inter-row tilling and apply fertiliser (poultry manure, NPK, or another nutrient blend) to support plant growth. Choice of agro-chemicals and frequency of application differs from farmer to farmer and is influenced by information on production methods and available resources. As they emerge, new shoots are removed from papaya plants to focus plant resources on the main stem. Farmers endeavour to apply borax once after fruiting to prevent deformities caused by boron deficiency, but this is not always financially feasible. Most often, agro-chemical inputs are purchased from local input suppliers or obtained from the Department of Agriculture or the Taiwan Technical Mission, and poultry manure is purchased directly from livestock farmers.

Farmers begin harvesting when plants are aged nine to ten months and select fruits at the first indication of skin yellowing (known as 'colour break'). Papayas are picked by hand from small plants; however, a plunger or a bamboo shaft with a sponge attached to the tip is used to dislodge fruits from taller plants. During harvesting, papayas are transported in buckets or newspaper-lined wheelbarrows to a central location and packed in plastic crates (for export or tourist markets) or newspaper- or leaf-lined wooden boxes (for local market). Prior to packing, some farmers spread fruits in the shade for further ripening, but most pack fruits immediately and cover boxes with a tarpaulin or woven bag to encourage ripening for two to three days before transport to market. Fruit is sometimes, but not always, rinsed and graded during packing. Heightened care is taken in the selection and handling of fruits for export. In fact, exporters often come to farms and harvest themselves to ensure quality criteria are met. Fruit not purchased by exporters

– either because it does not meet quality standards or is in excess of their demands – is sold on the local market, where consumers are considered to be less exacting.

Like for papaya - it's one acre [of] papaya [on our farm] - we can't harvest all papaya and take it to the local market. It'd be a lot of quantity. So what we do, we just divide it. Just give it to export some and leftover we take it to the market. But export we prefer, export is the best because they give little bit extra money, more money. For example, if the papaya maybe you selling for FJ\$1.50 or FJ\$1.80 a kg in local market, the export, they can give us FJ\$2, FJ\$2.50 a kg. But the only thing is that they have to... They will choose all [of] the quality one (fruits). Local market we can sell all. (Papaya and tomato farmer)

Sigatoka farmers and rural middlemen typically leave for Suva in the evening so as to arrive in time for the pre-dawn wholesale market. If possible, they sleep for a few hours in their trucks and then wake up in the middle of the night to begin wholesaling. Papayas are sold by the 10 kg box and, when transactions are completed, boxes are transported by a wheelbarrow operator to a location specified by the buyer. After the market opens and vendors set up their stalls, farmers and rural middlemen retrieve their boxes and return home.

Vendors retail papayas by weight or in piles. Although most retailers who sell papayas also sell an array of FV, there are several dedicated fruit vendors in Suva who specialise in papaya, pineapple, and watermelon. Unripe or half ripe fruit are typically priced highest. Damaged and very ripe papayas often are sold for discounted prices, whilst over-ripe and rotting fruit are discarded or given to a local swine farmer. Generally, fruits are considered saleable for several days; however, high levels of wastage were observed at the markets and vendors reported throwing away up to one third of papayas due to post-harvest deterioration and damage.

6.5. Tomato exemplar value chain

6.5.1. Selection of tomato exemplar chain

For tomatoes, multiple commercial production regions were identified by government stakeholders who took part in the basic systems mapping workshop, including the Sigatoka Valley, Beqa Island, the peri-urban area surrounding Suva and Nausori, and the major agricultural

areas of the Central Division. Farmers and rural middlemen were identified as important to the transport of tomatoes from these growing areas to the capital region, where they are retailed by market middlemen. Figure 13 presents the main functions, actors, and supporting institutions in Suva-Nausori's tomato supply.

<u>TOMATO</u>	
<u>FUNCTIONS</u>	<u>PARTICIPANTS</u>
Prepare farm	Farm families (Sigatoka Valley, Naitasiri, Tailevu, Rewa Delta, Nadroga, Beqa Island, Suva-Nausori peri-urban corridor), paid labourers, home gardeners, villagers, institutions (e.g. schools)
Produce and harvest	Farm families (Sigatoka Valley, Naitasiri, Tailevu, Rewa Delta, Nadroga, Beqa Island, Suva-Nausori peri-urban corridor), paid labourers, home gardeners, villagers, institutions (e.g. schools)
Identify market	Farm families
Sell to rural middleman or processor (optional)	Farm families
Processing (optional)	Processors, paid labourers
Transport to market	Farm families, paid labourers, rural middlemen, processors
Sell to retailer	Farm families, paid labourers, rural middlemen, processors
Sell to final consumer	Market and road-side vendors; eating-out establishments; supermarkets; small shops; institutions
<u>SUPPORTING INSTITUTIONS</u>	
Donors (e.g. external funders who support research and road works), financiers (banks and microfinance organisations), national government (including Department of Agriculture, Ministry of Health, and Ministry of Rural and Maritime Development and National Disaster Management), local town councils, agro-input suppliers	

Figure 13. Main functions, actors, and supporting institutions in the tomato supply to Suva-Nausori

Data sources: Basic systems mapping workshop, detailed chain mapping workshop, interviews, and observations

The government stakeholders in the FV sector suggested two possible chains to serve as exemplars (Figure 14). The first involved production in school gardens for use in school canteens, whilst the second encompassed production in one of the major growing regions and sale through market middlemen. Due to the Sigatoka Valley's prominence as the country's major horticultural growing region and the likely minor importance of school canteens to overall

population consumption, the chain linking tomato production in Sigatoka to market middlemen (both those who wholesale and retail and those who exclusively retail) in Suva-Nausori was selected to be the exemplar.

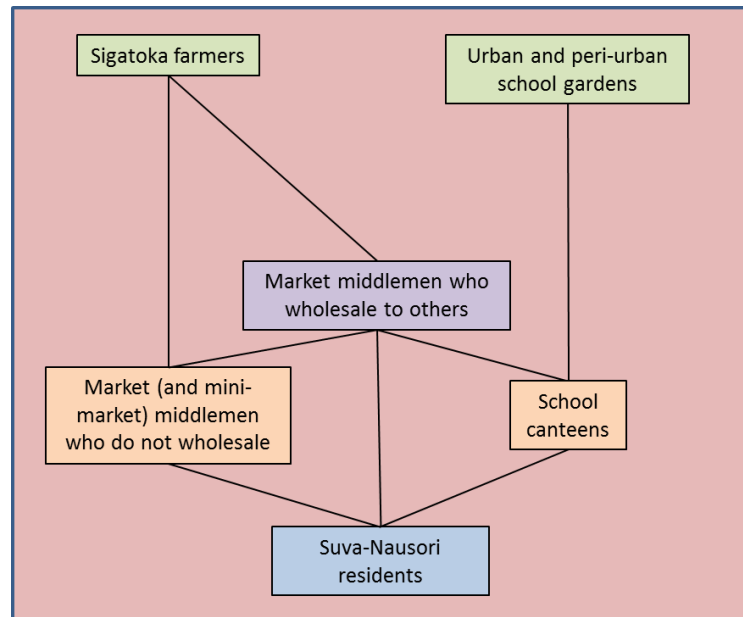


Figure 14. Tomato chains suggested by government stakeholders as possible exemplars, based on their perceived potential to increase consumption amongst Suva-Nausori residents
Data source: Basic systems mapping workshop

5.3.1 Basic structure of chain

During Fiji's main growing season of May to October, tomato production is widespread in the Sigatoka Valley amongst small- and large-scale farmers; in fact, nearly every farmer in this study who grew papaya also produced tomatoes. Despite this, many lamented that high competition meant tomato production in the main season is barely profitable and thus they preferred off-season production, which is perceived to provide greater scope for profit (but also higher risk).

Tomato is very good crop also, but better to plant that one in like off-season. When [in] the season, everybody bring the tomatoes [to the market]. We sell like we [are] giving [the tomatoes] free to them (vendors). One box [sells for] about FJ\$8 [or] FJ\$10. There's no pay in FJ\$8 [or] FJ\$10. This time I got the tomatoes in the farm. Because I try - every time I'm trying to be in everything, every crop to plant in off-season. See, but you know, yesterday and the whole of this month, the weather was very nice. Then I put the tomato seeds... but this heavy rain is going to damage [them]... I don't know how

many percent I'm going to plant and how many percent it gonna wash away. (Papaya and tomato farmer)

Figure 15 depicts the main material flow processes in the exemplar tomato chain. Farmers use both hybrid seeds purchased from local supply shops and open-pollinated seeds sourced from the Department of Agriculture or saved from their own production. Seedlings are raised for several weeks in small plots before being transferred to fields. Land preparation follows the same approach used for papaya production, except with different timing for fertilisation with poultry manure. As with papaya, in the first few days after planting, farmers seek to keep the soil moist and irrigate by hand, if necessary. Also, to help maintain soil moisture and control weeds, the inter-row space is tilled within a week of planting. Once plants are stable, farmers fertilise with NPK and urea, and, after flowers emerge, they apply pesticides on a weekly or bi-weekly basis. Farmers did not report using herbicides in tomato production, although during the off-season farmers sometimes weed plots by hand. Some farmers also consider staking and pruning to be important to plant care, particularly when fruit prices are high.

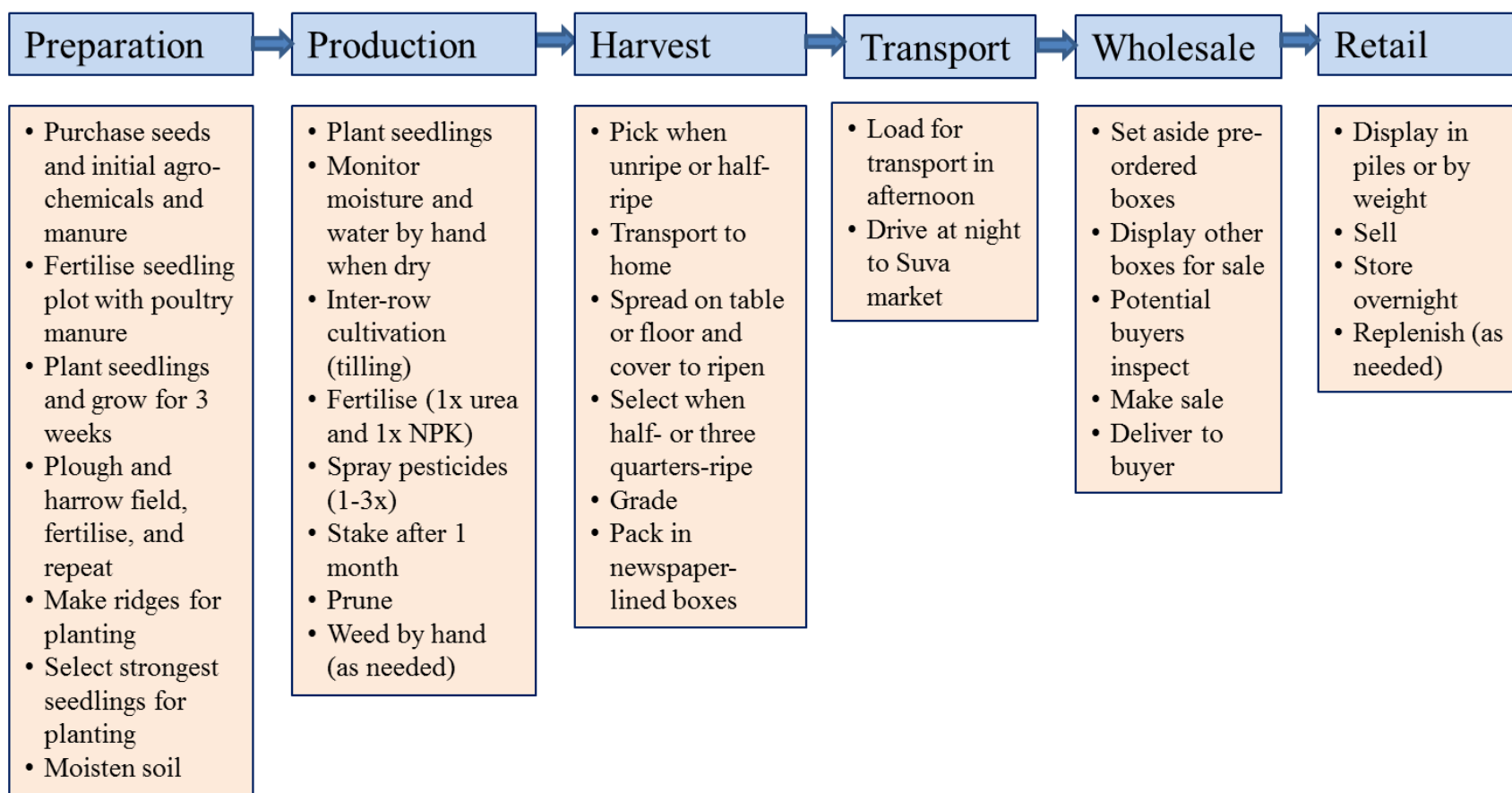


Figure 15. Material flow processes in the exemplar tomato chain

Data sources: Detailed chain mapping workshop, interviews, and observations

Farmers begin harvesting about three months after transplanting seedlings and continue for several weeks. Fruits are picked unripe and transported to farmers' homes in wooden boxes or plastic crates. At home, tomatoes are spread on tables or the floor (lightly cushioned with sawdust or woven bags) and left for several days or even weeks to ripen. Some farmers cover the fruits with a tarpaulin or woven bag to encourage ripening, but others leave them uncovered. As fruits mature, they are packed in newspaper-lined wooden boxes (about 15 kg) and loaded alongside papaya and other FV for transport to Suva market. As with papaya, sorting and grading of fruits is sometimes, but not always, carried out. Transport and wholesaling processes mirror those for papaya, with transactions taking place at the pre-dawn wholesale market and farmers and rural middlemen fetching wooden boxes from customers before returning home.

During the main growing season, many FV vendors sell local tomatoes; however, in the off-season local tomatoes are only available from a small number of retailers who source them from Beqa Island or the peri-urban area. Most vendors sell tomatoes in piles, but some larger vendors also sell them by weight. As with papaya, lightly damaged, very ripe, or very small fruit are offered for lower prices, whilst heavily damaged fruit are thrown or given away. Tomatoes are considered saleable for several days and vendors reported low levels of wastage (under 5%); however, substantial waste was noticed in field observations in the market.

6.6.Conclusion

This chapter introduced the structure of the FV marketing system in the Suva-Nausori corridor, mapped the three exemplar value chains, and identified the major activities and actors involved. The local FV marketing system serving the Suva-Nausori corridor was observed to be relatively basic. Farmers or rural middlemen transport fresh produce from farms to urban markets, where it is sold (usually in loose form) to urban consumers by the farmers themselves or market middlemen. Short, peri-urban chains are more likely to be vertically integrated than longer chains, with peri-urban farm families often carrying out all activities between primary production

and retail. Even for longer chains, there typically are no more than three businesses involved between production and retail.

For each of the three crops selected to be the focus of this research, multiple chains serving the Suva-Nausori market were identified and one was selected to be the exemplar. For amaranthus, the exemplar chain covers production by peri-urban farmers and sales by farmers and middlemen through market and door-to-door channels. For papaya and tomatoes, the exemplar chains cover production in the Sigatoka Valley and sale in Suva-Nausori markets, with farmers, rural middlemen, and market middlemen being the major actors.

Important value chain linkages were identified in all three exemplar chains. Farmers are highly dependent on the agro-input supply industry for seeds and agro-chemicals. Even for amaranthus, a self-seeding plant that can grow wild, large quantities of fertiliser and pesticides are used by farmers who sell it commercially. Many farmers depend on middlemen to transport and sell their FV at markets, especially those who live in more remote areas. Thus, linkages with these actors are essential for farmers to access markets. Finally, market middlemen rely on farmers and rural middlemen to deliver the quantity and quality of FV they need at a price they can afford, with clear implications for consumers when this does not happen. In the next chapter, the reasons underpinning current chain structure and organisation are explored.

CHAPTER SEVEN: VALUE CHAIN ANALYSIS OF EXEMPLAR FRUIT AND VEGETABLE CHAINS

7.1.Introduction

The previous chapter described the structure of FV marketing system in Suva-Nausori and the three exemplar amaranthus, papaya, and tomato value chains. This chapter reports findings of the value chain analysis, in which these three chains were investigated in detail through mapping workshops, interviews, and observations. The analysis seeks to go beyond basic description of how the chains are organised and behave (Chapter Six) to identify the incentives to behaviour and the trade-offs experienced by the different chain actors (i.e. why they are organised and behave as they do). After describing the degree of coherence between what consumers say they value in FV and what value chain actors think they value (Section 7.2), the analysis addresses the three major conceptual dimensions of value chain analysis from the strategic business management literature: material flow (Section 7.3), information flow (Section 7.4), and relationships (Section 7.5). Section 7.6 summarises the chapter.

7.2.Recognition of consumer-defined value

Across the three exemplar value chains, actors demonstrated a strong understanding of the major product characteristics that urban Fijian consumers associate with quality (see Chapter Five). Amaranthus farmers and middlemen discussed how different consumer segments have different preferences for leaf size, and related this to taste. They also described consumers as looking for large, fresh bundles, in which the leaves have not yet started to flower. Many farmers and middlemen strongly believed consumers will not accept leaves with any visible insect damage; however, a few noted that a subset of consumers consider some leaf damage to be an indicator of low pesticide use.

Most of the people prefer the small leaves. That's what I'm telling you. What you want, maybe myself didn't want it. What she want, maybe myself I didn't want it... Some people prefer the big leaf, some people prefer the small leaf. But, I said, Fijian people

prefer the big leaf. The Indian people mostly prefer the small leaf, the one with the roots. They prefer that one. (Amaranthus vendor)

First, they (consumers) look at the size of the bundle. If the bundle is good, big or small or... If we go to the market you can see plenty different kinds of bundle. Some of the middlemen they buy one bundle [and then] they [split it to] make it two and some farmers they give [a] good bundle. And secondly, they (consumers) look for the leaves. It's like damaged, insect has eaten it or no? And the quantity is there, the quality is there or no? It's dirty or is it clean? It's soft or it's hard? This is the kind of things the customers look before they buy. They are very choosy, very choosy. If we got dirt inside, you didn't wash it nicely, or soil is on the leaves, obviously no one will touch that thing, they won't buy it. If it's clean, if it's in good shape, it's soft, it's quality, then you don't have any problem. They just come, just pick [it], and they give the money and they go. (Amaranthus farmer-cum-vendor)

Actors in the exemplar papaya chain described the local market as less demanding of specific size and shape attributes than the export and tourist markets. In particular, farmers and middlemen noted that Suva-Nausori consumers accept both round fruits from female plants and oblong fruits from hermaphrodite plants, although oblong fruits often are believed to be preferred. Farmers and middlemen discussed how different consumers have different demands for ripeness depending on planned use. Blemished fruit and very small fruit generally were described as unacceptable for sale.

For the papaya, if we have plenty papaya and the exporters come and buy, then we make more profit out of it. But the only thing is that the exporters only want the A grade and not the rest, whereas in the [local] market we are able to sell all kinds. (Papaya and tomato farmer)

... [H]ere we have got 2 kinds of papaya. One is the long ones and the other is the short and round one. They (Suva-Nausori consumers) always prefer the long ones... because the round ones is just hollow inside – inside is hollow – and the long ones is a bit fresher inside – no hollow kind of structure inside – and, also, it's more sweeter than the round one. Round one is bigger than the long ones. So you will see them (consumers) coming in [and] they will just go for the long ones first. (Amaranthus, papaya, and tomato vendor)

Some of the consumers they like to have [papaya] for one week, so they buy one green one, another half-ripe [one], like that, three quarter-ripe [one], and the ripe one. For today, [for] tomorrow, for one week... (Papaya vendor)

Actors in the exemplar tomato chain discussed a range of product characteristics desired by Suva-

Nausori consumers. Farmers and middlemen said most consumers prefer large, firm, red fruits, free of blemishes. However, some consumers were portrayed as only concerned with price and willing to accept any tomatoes. As with papaya, consumers were described as desiring different degrees of ripeness depending on anticipated use.

They want the big ones, the hard ones, the shiny ones... And they want both half-ripe, ripe ones, unripe ones. (Tomato vendor)

They look for quality, whether it's big or small, the colour. If they like it then they buy. Some people harvest them while it's still very green and immature and put them for a few days. The colour turns really light and there is no demand for that kind. (Papaya and tomato farmer-cum-rural middleman)

Some people they want the big one. Some they want the middle one. Some of the customer they just look [for] the lower price... They'll never see the quality. Then they'll take the smaller ones. (Papaya and tomato farmer)

Whilst actors across the exemplar chains highlighted the importance of a product's availability, cost, and physical appearance, those who engaged directly with consumers at point-of-sale (i.e. vendors) also described how consumers sought a pleasant and convenient shopping experience. This involves finding a variety of attractively displayed, high quality, low cost FV in one place, and receiving good customer service.

To increase your sales to me is the customer service, not only the product. It's the customer service: how you serve your customer, how you deal with them, how you talk with them. To me, when a customer comes to my table, I always say, "hi", "hello", "morning", or "good afternoon", "good evening", [or] whatever. And I talk nicely, politely to them. I ask them "How can I help you?" when they say something "OK give like this whatever, bla bla bla whatever," then after giving their change I always say, "Thank you for shopping with me. God bless you."... To me that's how you can increase your sales, increase your customers, like that. (Amaranthus market and door-to-door vendor)

Across the three exemplar chains, actors recognised that their business decisions have implications for consumer value. However, there is a strong belief amongst many— especially farmers – that local consumers are most concerned with quality attributes when supply is plentiful and price is low, and will accept any produce when supplies are limited. Local market prices are perceived to be driven more by market supply than demand for quality attributes.

...[T]he quality doesn't matters [to price]. At present if we had tomatoes in the market... the quality of tomatoes will be very low, but the price will be high. But when we got quality tomatoes, the price will be very low. (Papaya and tomato farmer)

7.3. Material flow and value addition

The *material flow* describes the movement of a product through the value chain. From a strategic business management perspective, the objective of the material flow is to maximise consumer value by efficiently delivering the optimal quantity and quality of product (Fearne et al., 2009). To assess the material flow, each activity in the chain is examined to identify issues that impede the addition (or maintenance) of value to the product or its smooth delivery to consumers. This section examines the material flows for the exemplar value chains and identifies bottlenecks and challenges at each critical link.

7.3.1. Input management and production

7.3.1.1. Seed material

The number of seed suppliers in Fiji is so limited that any disruption or bottleneck in their operations (e.g. weather, customs delay) presents a major challenge for the local FV supply (Section 8.2.1.3). Although hybrid seeds are sold through multiple local agro-input suppliers, nearly all are sourced and distributed by one major importer (approximately 90% of seeds) and one minor importer. These supplies are supplemented by seed saving by individual farmers (for open pollinated vegetable varieties) and some vegetable seed production by the Department of Agriculture and the Taiwan Technical Mission.

For tomatoes, a range of seeds are available on the local market, but few are considered commercially viable and none display all features desired by value chain actors and consumers (e.g. large size, firmness, high production potential). Farmers in this study favoured *Raising Sun* #2, a hybrid variety, for in-season production, and *Alton*, an open-pollinated variety, in the off-season. These varieties are preferred on account of their perceived suitability to local climatic

conditions, and because fruit are considered reasonably “attractive” to consumers and sufficiently firm to “stand the vibration” of transport on poor roads; however, growers described both varieties as producing undesirably small fruits following the first harvest. All *Raising Sun #2* seeds are sourced and distributed by Fiji’s main seed importer and while some participants praised this supplier’s efforts to find and sell varieties appropriate for Fiji, others feel constrained in their seed choices and complained that the range of available seeds is too narrow and varieties are suboptimal for off-season production, especially because very few farmers have access to nurseries.

[B]efore I was trying Alton [and] Harvester, but [now] I prefer Raising Sun #2... It’s a good tomato and when you plant it, when you plant the plant, it should be healthy. And when the tomatoes will be ripe, it’s not soft. And [in] this rainy weather, it’s not be bad... The rest of them will not be good. (Papaya and tomato farmer)

I think... [w]e don’t have the top quality seeds in Fiji, the high grade seeds, the hybrid seeds. These are the only the normal seeds we buy from [the major seed importer] ... (Papaya and tomato farmer)

Before 2011, most seeds for commercial papaya production were imported from the University of Hawaii, but since it discontinued germination of the *Solo Sunrise* variety (locally called the ‘Hawaiian’ variety) in late 2010, all papaya seeds have been domestically produced. Today the papaya seedling supply is dominated by the Department of Agriculture (which targets seeds to export-oriented farmers) and the Taiwan Technical Mission. Although a few independent nurseries have entered the market, most have struggled to remain viable due to lack of skills in seed selection and seedling production and strict biosecurity criteria for seeds. Chronic seedling shortages are reported to be a major challenge. For example, in 2012, the Department of Agriculture met less than 70% of its target for papaya seedling production. Papaya growers described extreme difficulties acquiring seeds when they needed them, as seedlings are not grown until orders are placed and demand consistently exceeds supply. Farmers reported waiting unpredictable periods of time for seedlings, which hinders their ability to accurately plan

production. Further, some farmers reported dissatisfaction with the available seedlings, noting that seed quality was superior when imported from the University of Hawaii.

We have got plenty problems too in papaya farming, like seed or seedling problems. At the time when we prepare the land, we don't have seedling to plant. Sometimes we order it [from] MPI (Department of Agriculture) and we get [it] late or sometimes they don't have [it]. These kinds of things we've been facing in papaya. (Papaya and tomato)

[Seeds from the University of Hawaii were] the best seeds. If we transplanted them in our farm, [we were] 100% sure they [were] going to grow. But [with] this one here (seeds from Department of Agriculture), we are unlucky. (Papaya farmer-cum-exporter)

7.3.1.2. Agro-chemical use

For agro-chemicals, affordability is seen as an issue but availability does not appear to be.

Several large and many small agro-chemical importers operate across the country. Although agro-chemicals are under government price control (input suppliers are authorised to charge the cost of the product plus value added tax, plus 17.5% for wholesale, and an additional 12.5% for retail), farmers view cost to be a major barrier to use and many believe cost is rising in real terms. Growers across the exemplar chains perceive agro-chemical use to be essential to the production of high quality FV, but often feel that high costs – especially for fertiliser – inhibit their ability to purchase what is needed. Despite anticipation of adverse impacts on quality and quantity, many farmers reported using cheaper (and possibly inferior) fertilisers or lower quantities than recommended. Large growers have the option to purchase agro-chemicals wholesale to cut costs.

Papaya planting is easy, but looking and taking care of it is really hard. Like expenses of fertiliser and chemicals and all these things is very expensive. If you don't fertilise, just the tree will grow up with no fruit. (Papaya and tomato farmer)

If you keep on buying all this material (agro-chemicals), after all at the end you see you won't have any gaining side, see. So always the poor farmers just use the cheaper material to gain something at least, you know. The price of [producing] tomatoes in Fiji is so dear. (Papaya and tomato farmer)

Chicken manure I'm using... Like every crop I'm using that one so for saving some of the money for the fertiliser, because if [I] depend only for the fertiliser [it will be] very expensive. [I] can't afford only for the fertiliser, so have to buy some chicken manure and use [it] in the farm. (Papaya and tomato farmer)

A subset of growers purchases agro-chemical inputs through a payment system. For example, a

few farmers described a system coordinated by the Taiwan Technical Mission for papaya production, in which they are supplied with the recommended inputs at the advised times for a flat monthly fee. Other systems also were described whereby buyers (middlemen or exporters) provide inputs in advance and farmers repay the costs incrementally as they harvest. Such systems are highly regarded by farmers as they smooth expenditures, ensure access to inputs when needed, provide a guaranteed buyer, and share risk in the instance of crop loss; however, they are less common for products targeted to local markets.

He (Taiwan Technical Mission technical advisor) was supplying the [papaya] seeds like payment system... He charge whole amount and we just deposit him FJ\$200... Every member planted 600 plants and he [was] just supplying like payment system. And when the pawpaw need the fertiliser, he supplied the fertiliser. And payment was monthly FJ\$50... So it was very easy to buy the fertiliser [and] buy the seeds, and he was teaching [us] a lot how to do the work in the pawpaw... [Without the payment system,] if one plant need 1 kg fertiliser, we can't afford to give 1kg fertiliser. We have to cut it [to] about half kg... (Papaya and tomato farmer)

Some of them (exporters) make the contract, you know... If they – some of them – supply the seedlings and fertilisers, [then] when you started picking the fruits, they deduct from that; maybe every month [they deduct] maybe FJ\$100 [up to] whatever [it] cost, maybe about FJ\$1000. They don't cut all, but they deduct small bit until they finish then you get your... It's good [to have a contract with an exporter]... It's easy for us, you know. If not, you have to look for the money and plant and buy, you know. If you don't get the background (contract), so you have to buy the seedlings, the fertiliser. The fertiliser is very expensive. (Papaya and tomato farmer)

Actors representing farming, retailing, input supply, and technical advisory support roles expressed concern about improper use of agro-chemicals and possible implications for human health and the environment (Section 8.2.2.1). This was attributed to a range of factors, including cost pressures, pursuit of short-term profit, and lack of knowledge. Pesticide misuse was described as particularly worrisome. Failure to comply with recommended withholding periods between pesticide application and harvest was raised as a food safety concern by a range of actors across the exemplar chains. Several farmers – particularly peri-urban amaranthus farmers – indicated, without prompt, that they were aware of and complied with withholding periods, to “give time for the customers” (Amaranthus farmer); however multiple input suppliers and

technical advisors offered anecdotes about farmers' inappropriately using pesticides in an effort to deliver products without insects or the damage that they cause.

It's quite alarming learning from farmers how they use these agro-inputs. It's really really alarming... For example, the use of a pesticide, the withholding period is seven to fourteen days, [for] certain crops it's seven days. But what I've noticed is that some of farmers... This is what actually what the farmer did: there's a solution of this insecticide already been in a 200 litre drum, half, cut half [with water]... The harvested vegetables is dipped into the solution and then let dry before transportation to market the next day. I asked that farmer, "Why you doing that?" He said, "Oh, because insects are still on the vegetables. Even at night they come out and some of these and they come and feed... This is just to kill all the insect before I take it to market." I mean, that is dangerous. I told him, "That is dangerous. You're not supposed to do that, because if you use that insecticide, it's supposed to be used only seven days before it is safe for consumption." But people don't know that. Farmers just want his crop to be in good looking condition without any bugs, any pests on it when he delivers it to the market. It's quite alarming. (Input supplier and technical advisor)

7.3.1.3. Other production activities

In addition to agro-input use, farmers described a range of on-farm activities to be important to the production of large quantities of high quality FV. These include weed control, irrigation, pruning, and staking. Farmers described how they make ongoing decisions about trade-offs between the costs – both time and money – and potential benefits of various production activities, and reported scaling back their participation in some activities when the costs are anticipated to exceed the gains. For example, several growers explained that they stake tomatoes during the wet off-season when prices are elevated and moist soil increases the risk of fruit damage; however, during the main growing season, staking is not widely pursued on account of the high cost and low anticipated additional profit.

Long bean is taking too much time and tomato is taking too much time for the labour. Put the bamboo there, tie the bamboo... every week or two times in a week just tie it, keep on going, tie it, keep on going. If a good time, good season, then you can have a good price for the tomatoes, then you can cover the price for the labour and something like that. If the market is flood[ed], if I add the cost, there is no profit there. Some of the time profit... So farming is also like gambling. Sometimes get the profit, sometimes no profit. (Papaya and tomato farmer)

Farmers across the three exemplar chains discussed challenges with adequately irrigating FV.

Many peri-urban farmers in the Suva-Nausori corridor are dependent on rainwater for home and

farm use, thus limiting their ability to irrigate. In Sigatoka, most farmers have access to an irrigation engine (either privately or shared) that can be used to draw water from the Sigatoka River for agricultural use. However, mechanical problems with the engines are common and several farmers noted that the high cost of fuel disincentivises use of irrigation.

Sometimes it doesn't rain for two weeks. Last time we had it, it was about eight weeks. We didn't have any rain at all. So that time like our farm, our chauraiya (amaranthus) farm, was all destroyed up. If there is no rain [and] if there is no water supply, it is very hard. (Amaranthus farmer-cum-vendor)

We have got group system. We get an engine from MPI (Department of Agriculture). But sometimes we are facing problems in the river – like sometimes less of water or sometimes we've got engine problems, sometimes... Most of the time we are facing problems with the engine. (Papaya and tomato farmer)

7.3.2. Harvesting and on-farm post-harvest handling

Making judgments about the optimal maturity at which FV should be harvested is an important consideration across all three exemplar chains. For amaranthus, farmers seek to meet the demand of a range of different consumer groups and balance the anticipated higher market price of baby leaves (single harvest) with the prospect of multiple harvests from mature plants. Although some farmers focus on harvesting plants at one maturity level or the other, many harvest some of both. Farmers with their own retail stalls or who have agreements with market middlemen often harvest amaranthus in the morning for same day sale, whilst those without a secured market harvest the day before and sell it at the pre-dawn wholesale market.

I take three kinds of chauraiya (amaranthus): the baby ones – the small one – the middle one, and the big leaves too. And when I put it on my table, they're for different prices. (Amaranthus farmer-cum-vendor)

Sometimes [we] break it (amaranthus), sometimes pull it. [We do] both, because the Fijian people (iTaukeis) they usually want the one we break it. Indians they like the small ones with the roots. (Amaranthus farmer-cum-vendor)

There is a strong belief amongst farmers that blemished fruit will not be accepted to the high value markets (export and tourist) and will be worth less at local markets. For this reason, papaya and tomatoes normally are picked prematurely to prevent destruction by pests, theft in the field,

and damage in transport (Section 8.3.1.3). Papayas typically are harvested one to two days before transport to market and packed in boxes in the field; however, tomatoes are picked several days or even weeks early and spread on a table or floor at the grower's home for gradual ripening.

If the papaya is in the farm 'til ripe, the bats and everything will attack and eat. So before ripe – [when it's] half ripe, we bring them home. If we leave them in the field, so they'll be attacked by bats. (Papaya and tomato farmer)

[W]e usually harvest tomatoes which are not really ripe, because if we pick that tomatoes by the time it will reach the market it will be out of order, it will be damaged. So we usually produce the mature ones, hard ones, which will ripe in about a week or few days, something like that. We pick [with] our hands [and] put it in the house. When it is hard, then we get the hard ripe ones. You spread it in the house properly, we cover it about three [or] four days, then we pack it... If it'll ripe in the plant itself, it will be too soft, because they'll be more of the insect. So we have to pick it and put it in the house. Then we have the hard ripe ones. (Papaya and tomato farmer)

Attention to quality control during harvest and post-harvest handling on the farm is closely linked to the financial benefit anticipated by farmers. Growers with close links to downstream actors (e.g. retailers, consumers) often devote considerable effort to ensuring their product is consistently of high quality. For example, this involves checking each amaranthus bundle individually for size, cleanliness, and constitution, or grading tomatoes and papaya to remove blemished fruits and maintain consistency in size, shape, and colour. Overall, farmers make the most investment in quality control when they expect the payoff to be greatest, typically when local supplies are moderate (i.e. no surplus or scarcity). For instance, many Sigatoka farmers do not grade tomatoes when there is a market glut, because “*there's no good money*” (Papaya and tomato farmer) to be earned, or market shortage, because they believe consumers will accept any quality.

Like at the moment tomato is very short here, so no problem [if] it's ripe or not ripe. The green one it will do. They'll (customers) take it. Just last week when I was in the market, then they were asking, “Hey, no tomatoes? Tomatoes today?” I said, “No tomatoes.” The man told me, “If you find anywhere, just buy it [and] bring it for us. We will take it [whether] it's ripe or no.” (Papaya and tomato farmer)

... If off-season, no sense to make it grading. If off-season, they just want the tomato. That time I never grade it. (Papaya and tomato farmer)

7.3.3. Market selection, transport, and wholesale

Farmers of all three products, but particularly tomatoes and papaya, often make production and harvesting decisions without careful consideration of wider supply and demand factors and trends (Section 7.4.1). Several Sigatoka growers lamented that it is not unusual for FV to be wasted in the value chain during the main growing season because most farmers grow the same mix of products and saturate the market. The tendency of farmers to produce FV without first finding a buyer was identified by one technical advisor as the “biggest problem” in the sector, as it regularly results in mismatches between supply and demand.

This year all the farmers see good price [for papaya], so they plant. But this is small island - where is the market?... Farmers all can cry now... Pawpaw will sell at FJ\$0.10-0.15 per kilo in January. (Papaya and tomato farmer)

[T]he problem with our vegetable farmers – they do plant vegetables without even having a market there in place. That’s the Fijian way of seeing things. Just go out there on the belief that when it matured, the market is there... (Technical advisor)

Farmers described poor roads as a challenge to the safe and timely delivery of FV from the Sigatoka Valley (although during the fieldwork a major road improvement project was underway on one side of the Sigatoka River). Plastic crates are known to be the most protective source packaging and are exclusively used for sales to tourist and export markets. For the local market, plastic crates are not used because of their high cost and farmers’ anxiety that they will be stolen. Instead, fruits are transported in wooden boxes that are lined with newspaper.

A plastic crate is very good for transporting pawpaw to the market from the farm. It doesn’t damage the fruit very much. But those wooden box, they damage a lot. (Papaya and tomato farmer)

...[T]he crate price is very high... [it] is FJ\$25 [or] FJ\$30. And the wooden box is cheaper – only FJ\$5. So at the market... If they (vendors) lost one crate, maybe FJ\$30 are lost, [but if] one box, only FJ\$5 are lost. They don’t want to pay for gain for this one is lost. (Papaya and tomato farmer)

Most wholesaling activities take place in designated car parks in Suva and Nausori. The recent relocation of the wholesaling area for the Suva market frustrated many value chain actors, as the new location was viewed as less secure and farmers and rural middlemen said it raised their

parking and labour costs, as wheelbarrow operators had to be hired to transport FV from the lot to market stalls.

From there (the new wholesale lot) it is really hard to sell in the market. We have to hire the barra boys (wheelbarrow operators) and pay more now. (Papaya and tomato farmer)

7.3.4. Retail

7.3.4.1. Market facilities

Rules restricting most wholesaling to pre-dawn hours and lack of storage facilities (refrigerated or non-refrigerated) at markets affect vendors' ability to maintain product freshness and adjust supplies to consumer demand during the day. This in turn leads to regular imbalances in supply and demand and frequent product loss. Moreover, the preservation of FV freshness is challenged for many vendors at outdoor stalls by lack of overhead protection. Some tie tarpaulins above their stalls or cover FV with a damp cloth to shield products from sun and rain; however these practices are known to provide only partial coverage.

The main one (challenge) is the weather. Number one is weather. Two - it's just like storage... lack of storage facilities... We don't store anything here because it's not secure. So all these things, the leftovers, we have to take them home. (Papaya and tomato vendor)

And the bhaji (amaranthus) is one problem is that, when the sun is up, when the directions change you can see the leaves they are falling down and you have to prevent them from the sun... Don't let the sun to just directly sun on them, otherwise they gonna fall down. And the customers they won't take it. The customers they don't like it. Because customers they want good thing, because they give you good money, so your service is the main thing, how you serve your customers. (Amaranthus market and door-to-door vendor)

Lack of parking at markets also was perceived by vendors to inhibit sales of FV by reducing access. Several vendors believed that the removal of the consumer car park in Suva (also the former wholesaling area) discouraged shopping. However, there was suggestion that a decline in purchases from the municipal market may have been paralleled by a rise in purchases from mini-markets and roadside stalls.

For the last one month or six weeks we are really finding it hard on Friday and Saturday to sell our produce because we don't have the parking at the market... It's (parking) about 200 metres away from the market and the customers they don't want to take risk to park the vehicle, then they walk down to the market, they do their marketing, and then go back to the [lot]... Instead of that they just go to another market which is near to them... (Amaranthus farmer-cum-vendor)

7.3.4.2. Product management at the market

In addition to these structural limitations, vendors make a number of decisions about how to display FV that they perceive to impact on its value. Several vendors described arranging produce on their stalls both in an aesthetically appealing way to attract buyers and in a functional way to prevent product damage. Leaves, such as amaranthus, are often moistened and re-arranged every few hours to prevent dehydration and relieve pressure on bundles at the bottom of the pile. Similarly, tomatoes and papayas are sometimes displayed with less ripe fruits on the bottom to prevent damage.

[Freshness,] depends on the pressure. Sometimes after a long time the bhaji (amaranthus) will be there, [it] will look like it's dying. So every time we have to just change it... just change the heap around. [Put] the down part one up... (Amaranthus farmer-cum-vendor)

You have to keep on checking [on the amaranthus display] in the market... Like we set it on the stall and customers they come they will pick from the top, some will pick from the down. Like they will scam the thing around. The leaves will be looking this side, the root will be that side, so we have to go shake it nicely, put it again, make it look neat. (Amaranthus farmer-cum-vendor)

As FV quality declines or in response to slow sales, promotional pricing often is used to move produce. When FV are sold by weight, consumers select the products they want; however, when products are sold in a pile, the vendor determines the composition of the pile. Some vendors mix high quality and low quality products together, but others separate by quality and sell piles of blemished, over-ripe, or damaged FV for a lower price. Another approach is to increase the quantity offered for a given price, for example, adding extra tomatoes to a pile or offering amaranthus on a 'three-for-two' or 'buy one, get one free' discount. Vendors described offering discounts as helpful to building relationships with consumers (Section 7.5.2.5).

We have to put the green one (papaya) at the bottom, half ripe, then ripe. And what about the small one or any damage one, we have to make the heap (pile). We make the heap and just sell it on the cheap price... [In the heaps we put the] damaged and the good ones... So that one we can get rid of it. Otherwise next day we have to throw it in the rubbish. Whenever you look for the heap one, that means it is the vendor's choice. If you want your choice, you have to pick from the pile and it will be as a kilo – FJ\$3 per kilo, FJ\$4 per kilo, like that. That's your choice, the consumer's choice. (Papaya vendor)

7.3.4.3. Door-to-door sales

Of the exemplar products, only amaranthus is sold door-to-door in substantive quantities. Some door-to-door sellers are small-scale farmers, but others are middlemen or have informal profit-sharing agreements with farmers. Competition between door-to-door vendors depends on target area, with high direct competition in some areas and none in others. It is common for door-to-door vendors to sell each FV item (e.g. a bundle of amaranthus, a small bag of beans) for a set price of FJ\$1 regardless of market supply conditions, especially if they grow their own FV or are in a profit-sharing agreement with a farmer. Door-to-door sellers consider the use of a fixed, low price and doorstep delivery service to be sources of competitive advantage over market vendors.

I sell for FJ\$1 in the village... If [there is a] higher price in the market, my price is only FJ\$1... The business people know – in the market [if it's] FJ\$2, I [will] give [it to] them [for] FJ\$1... (Amaranthus farmer-cum-door-to-door vendor)

7.4. Information flow

The *information flow* involves the generation, sharing, and use of information throughout the chain (Fearne et al., 2009). To assess the information flow requires questioning the sorts of information actors in a value chain receive on what, when, and how to produce and handle the product to increase value. This section examines the information flows in the exemplar FV chains, with particular attention to where flows may be broken or distorted.

7.4.1. Flows of demand information

Vendors learn about which products and attributes are in demand through discussions with and observations of other vendors and people purchasing at their stalls. These interactions provide critical information on purchasing trends that can be used to help them plan their supplies

accordingly. When products fail to meet consumers' quality standards or demand for certain attributes changes, vendors communicate this information over the phone or face-to-face to their suppliers (farmers or middlemen) both verbally and explicitly by changing or discontinuing their orders. For actors in vertically integrated chains (e.g. some amaranthus producers), interfacing with consumers gives them direct information on consumer demand.

You know, we have a butcher near the market and this butcher sells meatie bones, so whenever the meatie bones comes, people come to buy meatie bones and tubua (amaranthus) at the same time from the market... The meatie bones – they normally sell it three times a week when they bring the cows from the abattoir to the butcher, so those three days in the week we have high sales in tubua. The people buy. And then [I] sell it too. Some [buyers] sell it and some have it at home. So we always mark the butcher as well – when to get more [tubua]. (Amaranthus vendor)

The relationship is very important with customers. When they come and they buy good things, they [are] happy. When they not happy with anything... they come back and complain, "Oh, the cassava I buy it's not that good." "OK. Don't worry. We'll give you some, a few more. It's not our problem. It's from the farmers." We tell them. So we tell the farmers, "Oh your cassava is not that good. It's not good quality." (Papaya, tomato, and amaranthus vendor)

The extent of information shared between buyers and sellers appears to vary with their relationship (see Section 7.5.2), with greater information sharing between actors who have a committed relationship. For example, data collected on two amaranthus farmers' businesses revealed information flows of very different strengths. One farmer exclusively wholesaled his produce to vendors with whom he had long-standing relationships. When delivering supplies, he spoke with each customer about his or her sales and anticipated demand for the upcoming days. This information was then used to guide production, harvesting, and delivery decisions. The other farmer had few set customers and sold amaranthus primarily through the spot market and on his own stall. His engagement with buyers was minimal and sometimes contentious. For each trading day, he harvested as many bundles as possible with the hope that he would find buyers. During one observation, he experienced considerable product loss, as middlemen deemed his amaranthus to be of poor quality.

Price at urban markets is determined by local supply and demand and, given the long lead times needed to grow most FV, is usually not a major determinant of short-term production and harvest decisions (amaranthus can be an exception, as shown above). Farmers and rural middlemen set wholesale prices according to perceived quantity of FV available, interest amongst buyers, and the prices established by others. This information is obtained by observing or speaking with other sellers in the market and is often based on the previous day's prices. No farmer in this study mentioned the newspaper as a source of pricing information, although market prices are sometimes printed by the Department of Agriculture.

Both sellers (farmers and rural middlemen) and buyers (vendors) described feeling that they have little influence over the prices, with modest scope for negotiation; however, power in transactions increases for sellers when demand exceeds supply and for buyers when supply exceeds demand (Section 7.5.2.4). To select a market, farmers typically telephone various prospective buyers (e.g. local, tourist, export) after harvesting the product to discuss pricing.

Like off-season... if I harvest the tomato and I just call and see the hotel price, like [rural] middlemen (who sell to hotels), and I just see the market price. If the difference is only FJ\$5 to FJ\$10, then I just give it here [to the rural middlemen] ... And if one box difference is FJ\$20 to FJ\$25, FJ\$30, then I just take to the market, because some of the person there, they never see the price. They just want the quality things, eh? Like off-season things. (Papaya and tomato farmer)

There is no strategic supply planning across the FV sector, or even in specific farming areas. Farmers independently plan production, often planting the same product mix year after year or copying other farmers. When the media report high demand for a product or stories of a highly profitable product circulate amongst farmers, there is often a rush to produce it. Actors working across all three exemplar chains (farmers, vendors, technical advisors, and input suppliers) suggested this lack of coordination in supply planning contributes to the high fluctuations observed in FV price and availability and both product waste and shortage.

... [W]hen there is a province [on] that side [of the island] claiming that, "Oh, we received so many thousands of dollars; we just cashed (bought) our car by selling that

ginger,” [at the] same time [other farmers want to plant ginger] ... They never planted ginger, but they heard that [in] other provinces, they bought their cars with this ginger income, [so] they wanted to plant ginger. That’s the problem in here. It’s what they hear from outside that urge them to go into it without even like [a] little knowledge on how to go about it: crop husbandry practices... [or] how to select planting materials or when to plant it... (Technical advisor)

7.4.2. Flows of information on best practices and production techniques

Intergenerational learning is important for many farmers, and a main source of information on production techniques. Most have grown up in farm families and rural communities and learn skills from relatives and neighbours. Farmers also often discuss and observe what other farmers are doing and endeavour to replicate activities on their own farms.

That is the old method of farming. Our forefathers were doing the same and we’re still doing the same. (Papaya and tomato farmer)

Sources for further, more up-to-date information and skills training include Department of Agriculture extension officers, Taiwan Technical Mission technical advisors, private agro-input suppliers, and Nature’s Way Cooperative (only for export products). All four of these groups operate both formal and informal advisory services, in which farmers can either seek assistance with a specific query or participate in a larger training programme or workshop. According to participants in this study, formal trainings are largely focused on helping farmers access lucrative export and tourist markets and are highly regarded amongst Sigatoka growers. Value chain actors described few formal training opportunities to be available to farmers targeting local markets, such as peri-urban amaranthus growers. However, farmers in all three exemplar chains expressed an interest in receiving more intensive and frequent training.

In this area (the Suva-Nausori corridor), most of them, they are composed of Indians, Indian farmers, and they hardly ask us (extension officers) for training. They believe in their own experience - what has been passed down from generation to generation only, because it’s them who brought this amaranthus to Fiji. Yeah. So, they hardly ask us for training, but they ask for like, “like this one is?” They even know the insecticide, the pesticide. They might ask us a question, but they already know the answer. (Technical advisor)

We are the farmers, but they (extension officers) are assistants. The government should be come and tell us, “Not like this, this, this.” They never doing us, nothing. (Papaya and tomato farmer)

Often, farmers leave school at an early age to work on the farm and are not fully literate in any language or confident in English, limiting their access to certain information streams. For example, farmers who do not speak English may struggle to read printed resources or engage with an extension officer who does not speak their native language. However, there remains optimism that the younger generation of farmers will be more educated than older generations, thus facilitating information exchange.

You know, it's different when you educate an adult... It's better that they have been getting the system of education when they started from being young. Like going to school and all, secondary school... At least they know what is the general concept on what we are trying to introduce. But, I guess it's revolving. Maybe by 10 or 15 year's time, most of these Fiji farmers, most – I might say about 60% – may be educated ones, composed of educated farmers who went up to secondary levels... (Technical advisor)

7.5.Relationships

From the strategic business management perspective, the nature of *relationships* sets the foundation for material and information flows, and strong partnerships can give rise to opportunities for actors to innovate together (i.e. co-innovate) to optimise value delivery (Bonney et al., 2007). Examining the quality of relationships in the chain involves considering trust, collaboration, and commitment between actors, as well as issues of power and dependence, opportunism, and dealing with disagreements (Bonney, Clark, et al., 2011). This section outlines the relationships between different actors in the three exemplar value chains. Horizontal relationships – those between actors working at a similar level in the chain – and vertical relationships – those between upstream suppliers and downstream buyers – are presented separately.

7.5.1. Horizontal relationships

7.5.1.1. Labour sources

Most operations in Fiji's FV chains are small, family-run businesses. Family labour is trusted, inexpensive, and flexible, and an absence or shortage of family labour is perceived as problematic. For farm families, the migration of younger generations to towns for education and employment is regularly mentioned as a concern. For example, one grower described how his children had left the farm for jobs in the city, leaving him reliant on hired labour:

Most farmers have their family members to do it themselves in the farm. Myself, I entirely depend on the labourers because all of my children go out. They invest in their education and they do white collar jobs and they don't want to come back to the farm.
(Papaya and tomato farmer)

Local villagers are hired by most farmers on a casual and irregular basis to supplement family labour. Most labourers are tasked with necessary but non-value adding activities, such as digging and weeding, although, on farms with less engagement with quality control, labourers are involved in all activities. Unlike family members who are viewed as intrinsically invested in the business, labourers are considered less reliable and lower skilled. Sometimes the same people are hired repeatedly, but often the labourers change according to their interest and availability. Some farmers discussed a problem finding and retaining labourers.

There was a farmer, he was planting chauraiya (amaranthus) – five acres, six acres, like that [of] chauraiya. He was a big farmer. Now he stopped the chauraiya farming because [of] the problem with the labourers over there. If you don't harvest the chauraiya at the right time it will start flowering and if it's flowering then the leaf will start going bad - you know, hard. That's why so many farmer they stop growing chauraiya. (Amaranthus farmer)

Labourers are just worried about the wages, not doing the job. (Papaya and tomato farmer)

I don't use labourers to pack [papaya] in the case too for the local market, because we understand with the farmers [that] our money is the consumer. My bread and butter is my consumer... He'll buy more if I give him good quality. (Papaya and tomato farmer)

At markets, many farmers and rural middlemen hire ‘wheelbarrow boys’ or ‘barra boys’ to transport their produce to buyers’ stalls. Historically, barra boys were considered untrustworthy and likely to damage or steal produce; however, some participants described increased credibility in recent years with the establishment of an association of wheelbarrow operators and mandatory licensure to work at the Suva Market. Further, although wheelbarrow operators typically charge per load, some farmers hire the same wheelbarrow operators each trading day for a flat fee, which is considered mutually beneficial and cost-saving. For example, one wheelbarrow operator said he reduces his fees by approximately 25% if a regular customer hires him to make multiple trips.

Family labour also makes an important contribution to wholesaling and retailing, with multiple family members often taking part. For farmers who retail their own produce, the involvement of family allows for a division of labour with different people leading on different tasks. For instance, one or a couple family members may be primarily responsible for farming and wholesaling, while others run a market stall. Family relations also provide a range of other functions along the value chains. Relatives often help on each other’s farms, share transport or market stalls, or lend each other money. For example, one amaranthus farmer who retails in Suva on Saturdays described how he works together with different family members: he and his wife grow and harvest the amaranthus; his brother-in-law helps with washing and packing bundles; a neighbouring relative (who also has a farm) transports it to market; and he lends his stall to another relative for retailing on weekdays.

7.5.1.2. Farmer-to-farmer and vendor-to-vendor relations

Across all three chains, many farmers and market vendors also have a web of important formal and informal relationships with actors in similar positions in the value chains. Formal farmer-to-farmer relationships are significant for Sigatoka growers, who often are organised into groups by the Department of Agriculture and the Taiwan Technical Mission to facilitate the distribution of supplies and training. Farmers consider these sorts of groups to be helpful for achieving their

intended functions, but do not appear to use them as platforms for organising in other ways, such as collective wholesaling. A prominent example of formal coordination amongst farmers is irrigation groups. Several years ago, the Department of Agriculture operated a scheme whereby Sigatoka farmers could form small groups and receive a free engine to use to run irrigation systems. These groups largely remain intact, with farmers sharing the engines (when operational) following an organised or informal schedule.

There's four members [in our irrigation group... [We] just have to be like a family, eh? If you thinking that you want to plant today, then have to share with the other members. "Hey, today I'm gonna use [the engine]" [or] "OK, whole week I'll gonna use [it]. You use another week..." (Papaya and tomato farmer)

Sigatoka farmers also regularly collaborate informally on transport and wholesale. Rather than working through a rural middleman, many choose to share transport to Suva market. In some instances, farmers travel together, paying a small per-box fee to the owner of the truck and helping during wholesaling. In other cases, friends take each other's produce with or without subtracting a per-box fee. This is particularly common amongst farmers who have orders from customers across multiple days.

The one (farmer) with whom I'm going [to market], actually I give him extra, but he don't want extra money, because about half load will be his and a quarter mine and a quarter another fellow going with me. Three people, one truck. We help him [by] taking the bag in the market... He's a good man. Normally it's FJ\$2 per bag. Like [if] it's not heavy, FJ\$2 per bag. So what I mean, if you take 20 bag, [it will cost] FJ\$40. If [you take] one box papaya - it's heavy - maybe [it will cost] FJ\$3. But he don't count the bag. Last week I took 20 bags of eggplant, six box papaya, and about five bags okra. So if you calculate it [would] actually be FJ\$80 roughly. I gave him FJ\$50. OK, no problem. But normally if you go with some other people like if you don't know them, don't have any relationship, they'll charge you. (Papaya and tomato farmer)

Here we have make a system. You've got a van and you're also going to the Suva market. And also I'm too going to Suva. You've got the order. Your customer have called you and say, "You can bring a five box of tomatoes?" and tomato price is FJ\$10. Are you going to take that five box of tomatoes only for FJ\$50? No! Suva, eh? So you come and say, "Sell [for] me..."[and I say,] "OK. No problem. Get it." Sometimes I too got the order, [like a] two box of tomatoes order. So I'll just come and tell you. You say, "Yeah, sure." Give and take: the barter system they say. (Papaya and tomato farmer)

Land sharing was reported by several participants, with landowners or leaseholders and tenants entering informal agreements. Arrangements vary on a case-by-case basis. In some instances, tenants are allowed to farm free-of-charge. In other cases, a sharecropping arrangement prevails, where the tenant farmer and landowner/leaseholder cooperate for mutual income generation.

We (the landowner and I) just give and take. Sometimes they need the help and we just help them. We are just helping each other. This is called share farming - [I] give half [of the] money at harvest. (Papaya and tomato farmer)

For many vendors, informal horizontal relationships are also a form of support. Vendors often share table space or take care of each other's stalls when one person is away. These activities are sometimes done in goodwill and other times for a nominal fee. Despite affable interactions, many vendors feel high competition in the marketplace and are strategic in how and when they support nearby stallholders.

Well, in this market business... We talk to each other very well, like that, but it's a competition what we do. People will want to sell their own. They will say this, that, just to try to sell. Sometimes we sad, sometimes we happy, but we try to maintain our relationship, good relationship, because sometimes they help us too. If I'm late they will sell whatever. (Amaranthus, papaya, and tomato vendor)

7.5.2. Vertical relationships

7.5.2.1. Relations between agro-input suppliers and technical advisors and farmers

Farmers reported regular engagement with agro-input retailers, but few described substantive relationships. Poultry manure is purchased directly from poultry farms (mostly in the Suva, Nausori, and Lautoka areas) and agro-chemicals, seeds (except for papaya), and farm equipment are purchased from input supply shops. As noted in Section 7.3.1, the Department of Agriculture and Taiwan Technical Mission also supply some inputs – most notably papaya seedlings – for Sigatoka farmers. In addition, a subset of growers enter into contractual agreements with buyers, in which seeds and chemicals are provided (Section 7.3.1.2)

Many farmers described dissatisfaction with the level of support they receive from the Department of Agriculture's extension service, which offers advising and training, tractor rentals, and free or discounted supplies (at times). In Sigatoka, farmers described a large range of inputs and support provided (often for free) by the Government, but many feel it is insufficient and the provision of supplies is unreliable. Multiple examples were provided of the Department of Agriculture distributing free or subsidized agricultural inputs in an ad hoc or first-come, first-served manner, or only following an insupportable delay. Extension officers were described by a subset of papaya and tomato farmers as indolent (e.g. *"always sitting, having grog (kava)"* (Papaya and tomato farmer)) and partial to their personal networks. Several peri-urban amaranthus growers also expressed negative sentiments towards the Department of Agriculture. These farmers described feeling excluded from Government efforts to support farmers, which they feel are biased toward export-oriented growers and those in the Sigatoka region. Most amaranthus growers in this study reported little to no engagement with the extension service.

Sometimes the [Government] Ministers are coming... So the Minister says [to the extension service], "I want to go see farmers [to see] how you [are] helping." They [are] saying - the extension officers and field officers are saying - "We are helping this much, this much." So whom do you know, you've got the thing (input supplies), the friends are there. The Government are giving out things - like the chemical - like saying, like "each farmer [receives] chicken manure". Just saying this thing, [that a] truck will come [to deliver] chicken manure, just this. [But] they [are] never giving. Whom do you know, they just give it. (Papaya and tomato farmer)

Like the government is trying to help the farmers, but not all the farmers get the benefit from it. (Papaya and tomato farmer)

They (Department of Agriculture) never help us since I'm doing farming here... Ginger farmers, some of the dalo farmers - taro farmers - [and] sugarcane farmers - they get the help. We don't have any help here. (Amaranthus farmer-cum-vendor)

Some papaya growers viewed Taiwan Technical Mission as more supportive and less biased than the Department of Agriculture. Many Sigatoka farmers are part of formal groups coordinated by the Taiwan Technical Mission to receive regular technical advising and agro-inputs (see Section 7.3.1.2). Farmers who used these services considered the groups to be both useful and of high quality.

TTM (Taiwan Technical Mission), those gang every time they come here they help the farmers. Like every month they have a meeting here. (Papaya and tomato farmer)

7.5.2.2. Relations between farmers and rural middlemen

The engagement of rural middlemen for transportation and wholesaling is more prominent in the papaya and tomato chains than the amaranthus chain. Three reasons were given by farmers for choosing to work through rural middlemen: (1) lack of transport; (2) a wish to avoid travel to wholesale markets; and (3) a desire to gain access to high-value markets to which the middlemen act as gatekeepers (i.e. hotels or supermarkets). Rural middlemen are widely distrusted due to their perceived propensity to secure high earnings at the expense of farmers. Farmers who worked with them reported agreeing to a price when the product was exchanged, but not receiving payment until after the middleman returned from market. Several farmers accused rural middlemen of failing to meet price agreements when they stood to lose, but unwilling to share earnings when the market price exceeded expectations. However, farmers often described feeling dependent on rural middlemen and unable to demand fair payment for risk of losing access to the market. Rural middlemen substantiated farmers' concerns, acknowledging that they wait until they return from market to pay farmers to ensure they earn a profit even if margins are slim.

Well, some of them (rural middlemen) are good men and they used to talk politely. And some of them they just take it at the price you ask them from here - maybe FJ\$10 - and when they go to the market and sell, maybe they cut the price, maybe sometimes FJ\$7, FJ\$8 a bag. Depends like that. (Papaya and tomato farmer)

We don't have the advantage of getting up, you know? Whatever we get from the [rural] middlemen, we just have to take it because we don't have our [own] market. (Papaya and tomato farmer)

This business [there is] no losing side. Every time [it is a] gaining side. No losing side. (Papaya and tomato rural middleman)

7.5.2.3. Relations between farmers or rural middlemen and market vendors

Two main types of relationships dominated FV wholesaling: informal relationships in which vendors place advance orders for FV and uncoordinated transactions negotiated on the day (spot market transactions). Most farmers, rural middlemen, and vendors prefer selling and buying

through advance orders as it is perceived to reduce transactions costs, increase security of product flow (i.e. secured market for sellers and secured supply for buyers), and give vendors greater ability to specify the product attributes they want (e.g. ripeness, fruit size, etc...). Sellers often prepare FV to match order requirements and offer their highest quality produce to customers who pre-order. Additional FV are sold through spot market transactions, which are transient and characterised by limited trust. Spot market transactions are favoured by a subset of vendors who seek greater scope for leverage over price, prefer to shop around for quality, and are willing to accept the risk of being unable to acquire desired supplies.

... I mostly have phone contact with Chinese farmers or farmers from Sigatoka... So I just give them the order. Then early morning they come here and they at my stall. It [is] already placed at my stall. [The] only thing I have to [do is] pay them, that's it. I don't panic, I don't rush. I just come in my normal time. That's the best opportunity I have in my life because I don't have to rush. But I do get good service from them, because I have been well known about my business and I mean, the farmers, I get along very good with them. So [they are] very cooperative. It all happens how you treat them. If you are good to them, then they'll supply you the best quality fruits and vegetables. (Papaya and tomato vendor)

Some people they selling their papaya for FJ\$70 a box, some people they selling it for FJ\$50, some people they selling it for FJ\$60, some they selling it for FJ\$40. But we vendors we just go according to the price and the quality of what we want to sell. The price depends on the quality and the quantity... I use different suppliers. I don't use a steady supplier. (Papaya vendor)

Farmers and rural middlemen seek to build and maintain a loyal customer base. To strengthen and entrench relationships with return customers, many farmers and rural middlemen offer preferential pricing and endeavour to provide a consistent product supply, even in times of shortage. This was observed across all three exemplar chains. A small number of farmers also described selling on credit to trusted customers; however, offering this service to all vendors is considered risky due to a lack of a strong enforcement mechanism for ensuring payments.

When you go to make the business, have to be every time... you have to be like a friend with customers. Don't be cheeky and don't be like you are very high shot person, like that. My thinking, I'm very friendly with all my customers. If they're buying something... "Hey, I'm your customer. Long time I'm only buying only for you... Tomato, pawpaw, eggplant, or anything, bele, or anything... Just please..." If I'm selling this one FJ\$25 one box of tomato... roughly, I'm just telling you. "Just make it some special." Then I

just cut FJ\$2. “OK. You just pay me FJ\$23. You are my customer.” Then they don’t go to buy other trucks, other customer... They don’t go and see, like that. Have to make friends with the customers also. (Papaya and tomato farmer)

Some vendors also noted important benefits to building partnerships with farmers and maintaining persistent wholesaling links. Vendors in long-term relationships with farmers explained that they feel confident in the quality of the product and the service offered. For example, one papaya and tomato vendor noted that the “*dealings are much, much easier*” (Papaya and tomato vendor) with trusted suppliers and the persistent relationship means that it is possible to avoid the pre-dawn wholesale market and focus on retailing. These vendors described the importance of offering fair and competitive prices and cooperating with farmers to strengthen ties and secure supplies during periods of product shortage.

If the export is going, then that means we have about 20% of chances to get pawpaws from Sigatoka because they (farmers) get good paid by exporters... [We get] whatever is leftover... And when it comes here, we don’t have the quality. The quality is very low, so we cannot make money. We cannot make money in that, because we tend to keep it for two or three days. Maybe after two days, it starts to rot, starts to have a fungicide (fungus) in it. So we have to throw it [away]. So we have to be very cooperative with the farmers and, you know, very loyal. If they have good produce, then we have to tell them, “Oh, we’ll pay the same price as the exporters. We’ll give you the market price.” Then they will sell it to us. Likewise we facing today, if the farmer has a good crop, they’ll sell it FJ\$80 a box. So they make good money there. So we’ll pay them and in return they won’t go to the exporters, so they’ll just bring it to Suva. If we pay them less, than no, they’ll change to another person. That means we won’t be able to have it... (Papaya and tomato vendor)

However, many vendors maintain only tenuous links with farmers and are quick to switch suppliers as soon as they feel quality or prices are unfavourable. These persons asserted that no farmer could consistently meet their quality and/or price needs. They often retain the contact details for several farmers and switch between them and purchases on the spot market.

I have to bring the quality one [to my stall] and then people can want to buy it here. They like it. The quality is very important. I don’t buy anyhow. Sometimes your supplier can give you bad vegetable and you don’t like it, you know. You won’t be able to sell it faster than like the quality ones, so sometimes I tell them, “I don’t like the quality, so I have to look for another one (supplier). When you have the good one then I’ll buy from you.” It’s like that. (Amaranthus, papaya, and tomato vendor)

Sometimes advantageous market relationships are not cultivated through strategic effort, but come about due to good fortune and enthusiasm. A strong example is illustrated by the case of a market vendor who maintains a consistent supply of high quality local tomatoes in the off-season. The vendor developed a collaboration with villagers in an off-shore island through an initial chance encounter over a decade ago and has collaborated with them to develop a mutually-beneficial and exclusive trading relationship.

7.5.2.4. Power between suppliers and buyers in vertical relationships

The balance of power in the chains shifts between upstream sellers (farmers and rural middlemen) and downstream buyers (vendors) depending on supply availability. When a product is highly available, vendors can pick and choose suppliers; however, when supplies are limited, farmers and rural middlemen have the ability to be more selective in choosing markets. As described in Section 7.5.2.3, price was an important consideration in these transactions. Power is less likely to be leveraged in price negotiations when relationships are strong and enduring, such as those between family members or long-held business associations. For example, some farmers said they keep prices consistent for loyal buyers, despite supply and price fluctuations in the market. Several farmers described the importance of maintaining persistent links because it means that they will not be without a market in times of supply excess. For example, one new farmer shared advice he was given on this topic from an older farmer:

What he's telling me: "You stick to one customer. Be faithful to them [and] they'll be faithful to you." (Papaya and tomato farmer)

7.5.2.5. Relations between vendors and consumers

Vendors are keen to develop a base of 'dedicated customers' or 'genuine customers' who visit the market stall on a repeat basis once or several times in a week. Consistently offering high quality products at low prices is considered important for growing this base. Vendors described consumers as fickle and quick to change to a different seller if their demands are not met.

I always want my customers to be happy, because then I gonna say “OK when the customer is happy the next time they will come.” Because if not happy, they won’t come. And the main thing is the price. Yeah, price is one of the thing. And the second thing is your service, your service and the way you talk to the customers. You have to be very, very politely. (Amaranthus market and door-to-door vendor)

It depends on the weather. If it's rainy or we got plenty... like it's the bhaji (amaranthus) is flooded in the market, so every stall has it. So that time it's very hard. It's like only the genuine customers... because customers too, they change every week. Everybody wants good quantity, quality stuff. They want it cheap. So if your price is good or if your quantity is good, the quality is there, then they come. If no then [they] switch another stall. (Amaranthus farmer-cum-vendor)

Vendors’ efforts to build relationships with consumers closely align with their perceptions of consumer value. In addition to consistency, quality, and cost-competitiveness, it is common for vendors to strive to offer exceptional customer service, a range of complementary products, or a particularly appealing product display. As noted previously, price discounts are used often to draw consumers. Sales on credit are another strategy for strengthening relations and trust with consumers, but some vendors avoid this practice because they perceive that consumers have a high propensity to default on payments.

...[W]hen there’s like a vegetable or something which is in season, we give them more... Like okra, when there’s plenty okra, sometimes... we just tell them, “OK. We giving FJ\$2 for three plates.” They will buy. They [will be] happy with that. They will come back to us. No one is doing it but us there... we can do it. That’s how we make them buy from us more. (Amaranthus, papaya, and tomato vendor)

They (customers) know me and I know them well. So when they want sometimes credit, I give them credit. And then when I go another week then they pay me or sometimes go another day... because sometimes they are working somewhere so they get their wages in one week then they pay me. (Amaranthus farmer-cum-door-to-door vendor)

Most of the time I give credit, they never pay, so my thing (business) is run down. (Amaranthus vendor)

7.6.Conclusion

This chapter examined value chain actors’ knowledge of consumer value for the three selected FV products and then used the core analytical value chain concepts of material flow, information flow, and relationships to consider the exemplar value chains. Actors along the chains demonstrated a strong understanding of the product characteristics demanded by urban Fijians

and are aware that there is some heterogeneity in the requirements of different consumers, such as differing demands for amaranthus maturity or fruit ripeness. However, there is a strong perception – especially amongst farmers – that local consumers are primarily concerned with quality when supply is plentiful and prices are low.

Information on consumer demand is collected and shared informally by vendors to their suppliers. Little formal information is available on local market prices, demand, or trends. There is no sector-wide production strategy and farmers make decisions about what they will plant based on their past experiences, what their neighbours are planting, and what they have heard sold for a high price in the last season, which contribute to the challenge of alternating FV surpluses and shortages in local markets.

The actions of value chain actors are constrained by available options, resources, and information. FV production is heavily dependent on imported agricultural inputs and bottlenecks in the input supply are a key issue. Financial resources also appear to challenge many growers. Due to low profit margins and strong price competition, farmers and vendors often make decisions aimed at cutting costs (and thus keeping prices low) at the expense of engaging in activities that add or preserve product value. For example, low-cost wooden boxes rather than more expensive plastic crates are used to transport tomatoes and papaya from Sigatoka to Suva, despite widespread awareness that they are less protective of fruit.

The research and extension system (both Government and non-governmental) appears to be focused on supporting production for export and tourist markets, with less attention to producing for and marketing to local consumers. Services highly praised by farmers, such as technical advising and payment systems of agro-chemical inputs, are not readily available for crops targeted to local markets.

There are structural and policy limitations to transportation systems and local markets that contribute to product wastage (and reduced profits). For many farmers, transport links remain an issue to the timely and safe delivery of FV. At markets, lack of storage facilities and tight restrictions on when and where FV can be wholesaled make it difficult for vendors to optimally preserve FV and adjust their supplies during the day.

Strong relationships in the chain appear to enhance material and information flows. Persistent partnerships between sellers and buyers are linked to more secure supplies, lower transactions costs, and better quality produce. However, many vendors continue to prefer to maintain more tenuous links with farmers due to the perception that no supplier can consistently deliver on quality, volume, and price.

Vulnerability and risk in the system emerged as a major theme from the analysis and a chief driver of actions in the chains. The following chapter will explore sources of vulnerability and how perceptions of risk motivate value chain actors to take certain actions.

CHAPTER EIGHT: VULNERABILITY IN THE FIJIAN FRUIT AND VEGETABLE SECTOR

8.1.Introduction

The previous chapter reported findings of the analysis of three exemplar FV value chains in Fiji. A major theme to emerge from that analysis was a sense of vulnerability to threats perceived by chain actors. Although this is probably in part attributable to major crop damage in Sigatoka caused by a series of floods and a cyclone in 2012, it also reflects broader perceptions of insecurity and is highly relevant given the fragility of Fiji as a small island developing state (UN-OHRLLS, 2014) and the predicted rise in frequency and severity of extreme weather events in the South Pacific related to changing climate conditions (Australian Bureau of Meteorology & CSIRO, 2011; Barnett, 2001; FAO, 2008). This chapter builds on and extends the findings of the value chain analysis by exploring vulnerability across the exemplar chains and FV sector as a whole. It adopts Turner et al.'s (2003) definition of vulnerability in a socioecological system: “the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation or stress” (2003, p. 8074) and applies their Sustainability Systems Program vulnerability framework. The framework draws attention to the interactions between exposure to hazards, sensitivity to exposure, and resilience and is meant to be used as a general “point of departure” (Turner, Matson, et al., 2003, p. 8085) for considering vulnerability in a system. By examining the chain from a systems perspective and exploring influences on value creation, maintenance, and loss, value chain analysis generates rich information on perceived hazards and how actors experience, cope with, and respond to them, thereby facilitating the assessment of vulnerability.

The chapter draws on data collected in the mapping workshops, interviews, and observations, and is divided into two main sections. Section 8.2 presents major stressors or shocks to FV value

chains identified by chain actors. Using Turner et al.'s (2003) terminology, stress refers to a persistent or slowly increasing pressure, whilst shocks are a major perturbation or strike. These hazards, and the human-environment context in which they occur, are interrelated and can cause challenges or distress for both individual chain actors and the sector as a whole with important implications for FV availability, affordability, and acceptability. Section 8.3 outlines the ways in which value chain actors prepare for and react to these hazards. Section 8.4 provides a brief conclusion.

8.2. Major hazards in the FV sector

The majority of businesses in the exemplar FV chains are small operations, with household members providing the bulk of the labour. Most participants reported modest incomes and low levels of savings, and therefore described a need for consistent earnings to maintain business operations in the face of regular expenses. Given the seasonal and highly perishable nature of many FV, small ebbs and flows in supplies and sales typically are not considered a source of concern, but participants did express anxiety about any shock or stressor that would damage their supply, disrupt their ability to work, or result in a loss of customers.

8.2.1 Political and macro-economic hazards

8.2.1.1 Ongoing political issues

Fiji's four coups (1987 (two), 2000, and 2006) and ongoing political issues have had a broad destabilising effect on the agricultural industry. Participants across the exemplar chains explained how the coups resulted in a loss of skilled professionals needed to support and develop the FV sector. For example, what one input supplier described as the "coup culture" was believed to deter investment in Fiji's agro-input supply industry and to have prompted several seed procurement specialists to emigrate overseas. Several value chain actors also described increasing financial hardship following the coups, as the nation's economy retracted and several suppliers, local customers, and consumers left Fiji.

After the coup, our selling was decreasing. Like what we used to have one day is getting low. People (vendors) they minimise their selling... Our customer too, they disappear... I think it's because of money. They trying to keep not like [spend]... Before there was plenty. I don't know whether there was plenty, [but] it was a good time. You have plenty to share [with] your family, school. After the coup, we learn more. People are saving and like less people are working. Every week people are just coming out of their job, so people who used to come every week, every week, they now come only once a week on Saturday... (Amaranthus vendor)

When I compare to the situation of government in Fiji at the moment, I think it was good in a few years ago... in the past. Normally, like, I can sell about 200 or 300 bundles of dalo (taro) in a week. But now, I can only sell about 50 to 70 bundles a week because people are finding it hard to survive, to buy. (Papaya vendor)

8.2.1.2 Land tenure situation

Land tenure insecurity amongst FV farmers was identified as another factor contributing to instability for FV value chains. Few farmers in this study owned the land that they farmed; most were tenant farmers who leased agricultural land through the NLTB. Several had renewed their leases in the past decade and described high renewal costs. Lease non-renewal, in combination with young people seeking education and employment in the city, was described as a leading cause of changing FV value chains and rural demographics. Some farmers shared anecdotes of FV production being abandoned after a lease expired and the land was returned to the indigenous landowners. This was suggested to be linked in part to different crop preferences by farmers of iTaukei and Indian descent; however, in some cases, the land was said to be no longer used for agriculture.

The number (supply volume) of tubua (amaranthus) is getting lesser... First, their plantation has gone down... because the Fijians of Indian descent were on lease contracts to plant on the land [and] once that expired they had to leave. So the land they left behind is mostly cultivated now by iTaukeis with cassava, dalo (taro), or coconut trees or bananas. (Amaranthus farmer-cum-vendor)

This study found many FV market middlemen to be former farmers who moved to Suva at the end of their leases. For these retailers, farming knowledge and personal networks in rural areas are often an asset, as they can help with the identification and acquisition of high quality supplies. However, farming is preferred work and vendors regularly described a desire for land for this purpose.

I started in 1998. Before 1998 I was a farmer... I farmed for 28 years before I became a pawpaw vendor... You know the condition for land leases is that renewal depends on the landowners. If they want to renew [they will], otherwise you have to leave the land. That's why I sell the land before [it expired] - only two years [before] - [I] sell the land then come to Suva. (Papaya vendor)

8.2.1.3 Dependence on imported agro-inputs and a limited number of seed suppliers

Farmers across the three exemplar chains described heavy reliance on imported agro-chemicals, seed, and equipment, and were aware that this created pressures on the system. Even the use of poultry manure, a seemingly 'local' fertiliser, is based on the importation of chicken feed (Narsey, 2011b). Dependence on imported agro-inputs and prices set by overseas suppliers increases the sector's exposure to volatile global markets. As presented in Section 7.3.1.2, many farmers reported struggling with already high and rising agro-chemical costs despite local price controls. Due to strong market pressures, several felt that increased input costs needed to be internalised, with implications for their earnings, and thus resources available to re-invest in production.

The price of raw material, like the urea, the manure, the insecticide it's keep on going up every day by day. You can go this week [and] we can see another difference of FJ\$0.20 next week... A bag of urea was FJ\$20, FJ\$25... that same bag costs now FJ\$70. So we can't pass everything to the customer. We have to bear that. We can't say "OK the thing is going up, okay we put the bhaji's (amaranthus) price to FJ\$3 a bundle... Nobody will buy. (Amaranthus farmer-cum-vendor)

For tomatoes and other vegetables, farmers' ability to choose seed sources is limited mostly to open-pollinated seeds they save themselves or obtain from the Department of Agriculture or hybrid (or open-pollinated) seeds imported by the country's major seed supply business (Section 7.3.1.1). This business makes decisions based on its own goals for profit generation, but, because of the exclusive position as the only large-scale seed importer, wields considerable control over the local FV sector, by determining the selection and cost of seeds available. Seed shortages are not uncommon, as high humidity deters stocking large quantities and mandatory inspections in the exporting countries and Fiji can cause delays.

Agro-input suppliers gave good reasons for why so few organisations are involved in seed importation. In particular, they noted that the trade requires specialised knowledge, international networks, and high liquid assets. Fiji's size is considered a compounding issue, as few overseas seed producers are willing to fill small orders. The local production and preservation of seed material – for papaya and for other products – also was described by several input suppliers as problematic due to a lack of skilled seed breeders and scientists, which is believed to be linked to the country's challenges retaining educated professionals. This means that the national situation in regards to seed material is unlikely to improve in the near future.

We don't have breeders... In vegetables we don't have any... If you want to be self-sufficient, you have to first you need to do the groundwork right so that you have your own variety of seed material, your own variety of what-have-you of vegetable material that is suitable to your climate... (Input supplier and technical advisor)

8.2.2 Environmental hazards

8.2.2.1 Land degradation

Declining soil quality is a concern across the three exemplar chains. Several value chain actors (particularly input suppliers) expressed concern that agro-chemicals were used indiscriminately by farmers with detrimental implications on soil health. Input suppliers believe that farmers often choose poor quality (unsafe or ineffective) agro-chemicals to save money and apply them excessively or incorrectly due to lack of information and an absence of long-term investment in the land. For example, leaseholders are perceived by some to be more likely than landowners to engage in production practices incompatible with soil preservation, i.e. “*mining the land*” (Input supplier and technical advisor).

We found out that soil fertility is a big problem... soil fertility in the Central Division (where Suva-Nausori is located) because of the use of the conventional fertilizers. It's not just the use of conventional fertilizers, it's the abuse. They're (farmers) not using it according to the recommendation. The excessive use of fertilizer... The idea is with farmers, that you apply more, [then] you'll get the crop up very quickly and it will mature earlier. They're trying that. Somebody give them that silly idea and some day it just goes out to the farmers and they start doing things which is off the chart. And in the end, some

of them have problems with soil fertility because they found out that they cannot use the same piece of land after two or three years. (Input supplier and technical advisor)

Across the three exemplar value chains, intensive farming practices were observed, with high rates of agro-chemical use and tillage. Farmers commonly keep their fields under continual (or near-continual) production, instead of letting them lie fallow. However, many rotate crops from time to time to give the soil a chance to replenish different nutrients. No farmer in this study reported or was observed conducting soil analyses prior to fertiliser application and knowledge of the different chemicals and their proper management appeared low. Further, only one participant (an amaranthus farmer) raised the issue of soil erosion or described limiting use of agro-chemicals to preserve soil fertility.

You don't have to use too many weedicides in the farm, you know, killing the earthworms down below. Those are the main thing for fertilising the farm. (Amaranthus farmer)

Nonetheless, multiple value chain actors described experiencing the effects of declining soil fertility in recent years. For example, papaya growers noted declines in the length of time well-maintained plants bear fruits and vendors described a drop in quality in fruit grown on older farms.

Before the farmers used to harvest [papaya] for almost three or three and a half years, but now it is hardly reaches two years. (Papaya farmer)

At the moment I'm buying [papaya] from the Ra people (farmers), from Ra [province], not Sigatoka people. Because plenty complaints coming when we buy the pawpaw from the Sigatoka farmers. The consumers say that the quality is not very good. So [for the] last few months I'm buying from the Ra people... The new farmers, they're soil is rich and their pawpaw is quality. Quality means juicy and sweet pawpaw. (Papaya vendor)

8.2.2.2 Damage caused by pests or disease

Pests and disease are persistent stressors to FV production, but infestations and outbreaks also can act as shocks. Insect and animal pests are a well-recognised threat, with greatest risk considered to be pre-harvest. Farmers actively seek to control insect pests in their fields with pesticides. Many reported spraying insecticides on a regular basis (bi-weekly, weekly, or fortnightly) regardless of pest load. Some input suppliers and technical advisors expressed a belief that

pesticides are misused and overused, with implications for pest resistance (and consumer safety, as reported in Section 7.3.1.2). Some farmers described increasing challenges controlling pests and related this to shifting weather patterns.

[I spray insecticides weekly] because now the weather is changing... [There is] more rainfall nowadays... Now [it is] not like before when we used to have rain occasionally, [in] January, February, like that... Now [there is] rainfall all the time which comes with lots of insects. (Amaranthus farmer-cum-vendor)

Outbreaks of disease are interrelated with storms and flooding, and during the fieldwork, plant disease was a problem for some papaya producers. Despite acknowledging that plant disease threatens both individual businesses and the entire domestic supply of specific products, farmers in this study seemed to take a passive (helpless) approach to dealing with the real and recurring threat. In fact, no farmer in this study mentioned the use of fungicides in their production activities. One input supplier and technical advisor noted that there appears to be confusion amongst farmers as to the appropriate use of fungicides and insecticides for the management of plant health.

At the moment in Valley Road [in the Sigatoka region], after the flooding, plenty of disease come, so they affected the pawpaws (papayas). I've heard that the [Department of] Agriculture – when they know about the diseases – then they just destroy all of the plantations... (Papaya vendor)

[O]ne area we're trying to address with local farmers [is] the use of fungicide and how to differentiate between insecticide and fungicide for disease control, which is a big gap we've found... [They're] relying more on insecticide and weed-killers and fertilizers. In terms of disease control it's very poor. (Input supplier and technical advisor)

8.2.2.3 Natural disasters

Natural disasters – particularly cyclones and floods – strike Fiji regularly and shock FV value chains. In recent years, production in the Sigatoka Valley, where much of the agricultural land is located near the flood-prone Sigatoka River, has been affected seriously. Many of the papaya and tomato farmers in this study grew FV on low-lying land straddling the Sigatoka River and nearly

all reported major crop loss in 2012 related to the two major flooding events and cyclone that hit Fiji directly preceding and during the fieldwork.

Immediate impacts of natural disasters on consumers include FV shortfalls and accompanying price spikes. Participants in all three exemplar chains described an overall unmet FV demand during these periods of shortage, which led to elevated prices across the whole food group, regardless of whether a specific product's chain was impacted by the disaster. For example, when flooding affects production in the Sigatoka Valley, even prices for FV grown around Suva increase because they serve as dietary substitutes.

FV growers in this study described how natural disasters impact on their individual economic well-being and decision-making by affecting their immediate earnings, available capital, and future earnings. Crop destruction caused by natural disasters represents a loss of investment that can lead to an immediate interruption of profit generation as well as long-term economic hardship. The type of crop damaged affects the significance of the shock to farmer livelihoods. Sigatoka farmers described the impact as particularly grave when papaya is damaged, since the crop requires nine months of investment prior to recuperation of costs.

You know why if one time hurricane is coming or flood is coming, there is too much money going in the field. Like pawpaw (papaya), when I buy this one, I pay for the seeds FJ\$3200, only for the seeds. And I buy the fertiliser – very expensive. There is no money coming from the farm. Only whatever we got it in the bank or at my place at home, the pocket, we just spend that one. If any of the money is coming, rolling from the farm, it is very easy to just get there and spend here, get there and spend here. Like cyclone come and... the flood come... And whatever we collect the money, we spend in the farm. Have to do that until... Like pawpaw... How many money I spend in this farm? About roughly, I got the record, about FJ\$10,000 I have spent in this farm... fertiliser and chemicals and Borex - plenty thing I have to do. Every three months, have to put the fertiliser there. More than FJ\$10,000, I spend. Now only two times I have harvest the pawpaw. Don't know if the flood [will] come or the hurricane [will] come, then again, big loss. (Papaya and tomato farmer)

FV vendors described challenges acquiring sufficient FV supplies to meet consumer demand following natural disasters and spending more than usual to secure products (even those of low quality) to fill their stalls. The FV which is available goes primarily to vendors who have

longstanding relationships with farmers, and steep competition exists for remaining supplies.

However, not all chain actors perceive natural disasters to be bad for business. Growers whose farms are not damaged and vendors who can continue stocking supplies said shortages make it possible for them to increase prices and generate enhanced profit. During these periods, value chain actors often were found to give reduced attention to quality control and sell whatever they can harvest.

[A]t the moment, because of that flooding affected, the Sigatoka farmers, when they bring the pawpaw, when we cut the pawpaw sometimes [it is] white inside. The quality is not good. (Papaya vendor)

When there is a drought, [or] when there is plenty of rain and a hurricane, after that we can sell in a good price. (Amaranthus farmer-cum-vendor)

8.3. Reactions to hazards and strategies to enhance resilience

A common reaction amongst farmers and middlemen to shocks or persistent financial strain is to scale back activities. For farmers, this can include cultivating a smaller amount of land, switching to less time-intensive products (e.g. root crops), applying less or cheaper agro-chemicals, or reducing the frequency of sales. Typically, business and household savings are drawn on to support essential household expenditures, leaving little resources to invest in production for the upcoming season. This thus perpetuates the negative effects, as farmers struggle to rebuild their businesses and in the meantime produce suboptimal quality and quantities of FV. For middlemen, downsizing in response to a hazard can involve selling less frequently or offering a smaller range or volume of products.

If you haven't got the [money] for your labourers, so you have to work out how you're going to pay some of them. Just don't plant in large quantities. Small quantities we plant because it's very hard to use the labourers, so you plant less. Just we, us, two of us, we gonna control that. That's it. (Papaya and tomato farmer)

And this time, you know, just because of hurricane [I don't have high quality papaya]. When the flood came (January 2012) then I plant it, then again I spend too much money there and again the hurricane came (December 2012)... All the vegetables lost the money there and the pawpaw was crooked [to] one side. I put plenty levers there [and] put the stick to make it straight and cover [the roots] with the soil [to] upright the

plants]... So I spent plenty money, so I can't afford to put whatever fertiliser this pawpaw need, I can't afford to supply the fertilizer. So now I am harvesting [a] little bit, so slowly, slowly I'll gonna put some more fertilizer. (Papaya and tomato farmer)

[W]hen we started out, my husband was still working so we can spend more on the table [and] buy more things. After 2006 [or] 2007, he stopped work, you know. So we're using less money on the table and until now he's [been] sick. I prefer to keep the table so it's a source of income for us... We just come [to the market] on Thursday, Friday, and Saturday. But this week, I changed my mind. Everybody is healthy again and I changed my mind. (Amaranthus vendor)

Actors across the exemplar chains described a range of strategies used to increase resilience to hazards. These strategies are presented below in two categories: those relevant only to farmers and those relevant to actors at all steps in the chain.

8.3.1 Strategies adopted by farmers

8.3.1.1 Stock seeds

Some tomato farmers reported purchasing multiple packets of seeds at a time and storing them in the refrigerator until needed as a strategy to reduce potential disruptions to seed access.

However, farmers and input suppliers described this as carrying its own risks, as it is not uncommon for seeds to fail to germinate. When seeds do fail to grow, farmers are rarely refunded.

You know this time one packet of tomato seeds costing FJ\$18 to FJ\$20 a packet... Some of the farmers they buy a lot thinking that some of the time [when] the season comes for the tomato you can't get the seeds there. So better when the seed is there then, some of the farmers – also myself also – I buy a lot... like 20 packets [or] 10 packets. Then I don't know that this one is going to germinate or no. It is written there, "Keep it cool", but some of the time they can't germinate. [That is a] big [financial] loss there also. (Papaya and tomato farmer)

8.3.1.2 Apply agro-chemicals in line with recommendations

Agro-chemicals are viewed by farmers and technical advisors as necessary to add lacking soil nutrients and control weeds and insects. Investing in high quality agro-inputs and following best-practice production guidance from the Department of Agriculture's extension service or other technical advisory groups are considered strategies for optimising supply and profit. For example, in one farmer's words, "everywhere I spend money, I get money" (Papaya and tomato

farmer). However, faced with challenging choices regarding how to allocate limited funds, agro-input use was often impacted (Section 7.3.1.2). For example, one Sigatoka farmer related how it was common for growers to use fertilisers advised for sugarcane on papaya plants to save money:

Some farmers can't afford [to] buy... [the appropriate] manure (fertiliser)... They want to buy the cheapest one. Just like they are putting [the fertiliser] for the sugarcane – it's a different kind [than advised for papaya]. So [they] just go look for that one. It's a small price for that one... NPK [for papaya] is about FJ\$92 or FJ\$95 a bag... The sugarcane one is only FJ\$30. (Papaya and tomato farmer)

8.3.1.3 Harvest fruits prematurely

Papaya and tomato growers harvest fruit before they ripen as a strategy to limit losses in the field caused by birds, bats, or theft (Section 7.3.2). Some reported harvesting fruit one or two days before wholesaling, whilst others cited much longer times (up to a month). Although farmers view early harvesting as a strategy to reduce risk, vendors argue that it increases the probability of product wastage because fruits are of lower quality and less valued by consumers. For example, one vendor who sells papaya and other fruits described how prematurely harvested watermelons lack flavour:

We (vendors) [are] just telling all of our farmers to supply the right quality and the ripe fruits so that we can sell it by (to) the consumers. From eight years [ago until now], I'm just telling this. Like watermelon: I'm just telling how to harvest the watermelon so that they can bring the ripe one. Before they (farmers) harvest the melon, [they] just store it at their home for one week. Then they bring [it] to market. That means they [are] harvesting the three quarter ripe [fruits]. So in that fruits the sweetness is not there. When they harvest the ripe ones, that one's very sweet and the quality is good. (Papaya vendor)

8.3.1.4 Take on additional functions in the chain

Farmers often seek to take on more downstream functions in the chain as a strategy to reduce risk and ensure access to a market. For Sigatoka farmers, taking one's own produce to Suva to wholesale allows avoidance of rural middlemen and development of direct relationships with market vendors. Given the lack of trust of rural middlemen, this strategy is favoured by many farmers, but is only accessible to those who have access to a vehicle (their own or shared). For

peri-urban amaranthus growers, working along the whole chain from production to retail is common and was described by several as a way to increase earnings, especially if family members are available to help. Some of these farmers retailed at the market daily, but most sold on one or two selected days.

It's better for me to sell it by myself because you can get a good price. If you do the wholesale, it's FJ\$7 to FJ\$8 [per dozen], when people want to take it. But if you sell it by yourself, the baby one (variety) you'll profit, you'll sell it for FJ\$1.50 or FJ\$2. But the people who buy – the middlemen – they will ask for FJ\$10 or FJ\$8. They won't give you more. It's like that. For me, it's better to take it and sell it by myself. More profit there and it's really good. There are a lot of complaints from the people when they buy it from you like wholesale, when you do wholesale. In the middle weeks we go and do wholesale but mostly I like to sell it by myself on Saturdays. (Amaranthus farmer-cum-vendor)

In either instance, taking on more downstream activities diverts time and resources away from production, and can be inefficient if multiple partially-full trucks travel from the same region on a given day, which is often the case. For Sigatoka farmers, the trip is long and requires staying up most of the night. Several – particularly older farmers and those with illness – said that due to the arduous nature of the trip, they preferred to sell to a rural middleman.

[Whether a farmer sells at the market] depends if there is plenty people in the family – so you can sell your own stuff, you know? If not – [if there are] less people in the farm – then you have to wholesale it to the middleman. (Amaranthus farmer)

Well I was going [to market to sell my crops] for four [or] five years. It's very hard for us farmers... It's good money, but according to me it's very hard. We have to just load the thing [and] go [from] here (Sigatoka) to the market [in] Suva. [We spend] maybe FJ\$150 [or] FJ\$200 on fuel. And again you pay the market fees and the parking fees. And you have to pay [for] your breakfast – whatever you eat. And if you got two labourers, [then] you have to pay for them too – the breakfast or lunch. Then you reach home, maybe [in the] afternoon time. The next day you can't do anything; [you're] full tired. That's why I'm not going [anymore]. (Papaya and tomato farmer)

8.3.2 Cross-cutting strategies

8.3.2.1 Strategically organise relationships

Perceptions of vulnerability and a desire for greater control over supply often prompt actors to strategically organise their linkages in the chain (Section 7.5.2) by either building committed

relationships and/or diversifying relationships. These complementary strategies are often applied together, with farmers and vendors building committed relationships with several people to mitigate the potential shock caused by loss of a supplier or buyer and fluctuations in supply or demand. Participants said such arrangements also support consumer demands for consistent supplies of high quality produce and lower prices, because chain actors in committed relationships are less likely to behave in opportunistic ways.

... [S]ince we go to the market all the time, the customers will inform us to get their supply for the following week. So we always get it for them even though there is a shortage at times. So we have been making dealings like this and now they just come to the lorry and get their stuff. They don't look around and buy... they just know that this man at this time will come with our things. (Papaya and tomato farmer-cum-rural middleman)

I became a vendor in 1998, I start with the dalo and cassava, vegetables, [and] then I changed to food I found that was commonly bought in the market, like papaya, like fruits - mostly the papaya. From then I fix my own farmers - the four [I buy from], I [have] worked with from 2000 and [we are] still working together... The main thing is to know good suppliers, good farmers who know good pawpaw, [and who] know which pawpaw to harvest at the right time... (Papaya vendor)

8.3.2.2 Diversify product range

Many value chain businesses diversify their product mix to consistently generate income. In fact, all farmers in this study grew a range of products and many explicitly said that they did this to help them “roll” their businesses from week to week and season to season and to provide a buffer if one crop is damaged or unsuccessful. Farmers in the tomato and papaya chains described a benefit to producing products that can be harvested at different times. For papaya, intercropping is sometimes pursued before the plants bear fruit or after a natural disaster when the loss of some plants means that there are empty spaces in the field. However, according to growers, this is considered somewhat risky as the intercropped plants compete with the papaya for nutrients.

Like we nearly harvest every day... We plant bhaji (amaranthus) [and] with it; we plant some more the supplementary crops, like rourou (taro leaves) and dhaniya (coriander) and cabbage, [to offer something] if the flow of the bhaji breaks. Like if we don't get rain continuously- sometimes [in] two weeks [we have] no rain - then the young ones they can't grow as fast as we expect. So we have to shift to another crop. So if the thing (amaranthus) is there, [then] we harvest everyday but the main one (day) is on Friday,

because [on] Saturday, [the] whole day I have to be in the market on my stall and the rest of the days I'm in the farm. So we just do the big harvesting on Friday, but all the small orders, like five dozen [or] two dozen, it keep on going every day. It depends on our stock. (Amaranthus farmer-cum-vendor)

... What farmers do is [when] we plant pawpaw (papaya) – in between [rows] is too much space for just nothing. It's lying [fallow]. So if we have got seedlings for small things like cabbage or like tomatoes, we think [we can use the time in] between - in three month's time or two month's time - we can do another cash harvesting [and] like cash money will come. So we can just plant in between and cut, sell it to the market. Cash money will come [that] we can use here again in this pawpaw. (Papaya and tomato farmer)

Similarly, all vendors who participated in this study sold a range of FV. Offering a variety of products is used to entice and satisfy consumers. This often requires obtaining FV from multiple sources, even for those vendors who have their own farms.

... [W]e come early [to the wholesale market] because sometimes we don't have the [dhaniya (coriander) and] customers want dhaniya. What we don't have at the farm, we buy it. (Amaranthus farmer-cum-vendor)

8.3.2.3 Invest in infrastructure and equipment

Actors in the exemplar chains described a benefit to investing in infrastructure and equipment to increase resilience to hazards. For farmers, irrigation systems, drainage systems, and nurseries were considered to be “critical factors” for supporting the continual production of high quality FV. Irrigation helps protect crops during periods of inadequate rainfall and drainage helps remove excess water from agricultural soils, including floodwater. Nurseries improve the seed and seedling supply by providing protection from sun, rain, and flooding, and can be used for off-season production of high value FV, such as tomatoes.

Tractors, draft animals, and vehicles also are considered assets for reducing labour needs and increasing agency in the chain. Tractor ownership helps aid and expedite production and reduces reliance on rentals from the Department of Agriculture, which some participants described as unreliable. For farmers with small plots or sloping land, draft labour is preferred for this purpose. Farmers explained that ownership of a truck or van allows them to shop around for inputs and be

more selective or markets. Those without vehicles feel beholden to rural middlemen or their personal networks to provide transportation.

We have no money in the bank balance, because we have nothing. But we [are] just making (building) our property, like that. If no tractor, can't do the job. So just borrow some family's little bit of money. Collect the money, pay them and keep on going. Collect some money. Then just ask some more family or friends to give me just another little bit money, then I can buy the van. Something like that. If no van, how can I take the vegetable to market? Like that. That is the way we going. Until now we have no money in the bank, but I'm very happy that I've got my two [parcels of] land and build a tractor and a van and our lease have renew. (Papaya and tomato farmer)

For market middlemen, vehicle ownership facilitates consistent procurement of high-quality supplies, especially during periods of shortage. Owning a car, truck, or van can be particularly helpful for mini-market vendors as they often have to travel to and from Suva or Nausori to purchase produce (and sometimes must transport leftover produce home at night if the facility is insecure). Vendors purchasing through the wholesale markets emphasised that arriving early (i.e. before 05:00) was important to acquire desired products; however, there is no public transportation in the middle of the night and taxis can be expensive and sometimes charge an extra fee for transporting FV.

You can see that all these people (other vendors) here are not selling pawpaw like we are doing. So we should maintain this supply every day. So we don't want our customers to go running around, so we don't want to lose our customers... We are competing, all these people are competing, so that we sell the best to the customers... So that's why we bought one van so that we have transportation. (Papaya and tomato vendor)

Farmers and vendors noted that low profit margins and savings make capital investments difficult, especially in the absence of external funding. When money is borrowed, repaying loans can create an additional financial stressor. Many considered the perceived inability to make these investments to be a critical barrier to improving the quantity, quality, and consistency of the FV supply to local markets.

...[A major] challenge [for farmers] is capital. They don't have enough capital to even put up a nursery. You know, how could they produce... how could they raise a good nursery bed and all without even having a proper greenhouse? (Technical advisor)

My tractor was bought from the bank about 12 years ago. It was in tender, I just bought. Then I start paying, paying, paying. Very hard times, you know. Look after the daughters and pay the [bank], if you loan from somewhere. (Papaya and tomato farmer)

In [the] off season we need to have... facilities in order to produce tomatoes... [and other] vegetables in Sigatoka Valley, that's the interior. In [the] off season there [they] would be facing hurricanes, they will be facing - the farmers - facing the heavy rains, you know, sometimes big floods... For protection of that, you have to use greenhouses, plastic houses and that is cost... we poor farmers, we can't afford that. So that's the problem... In [the] off season farming you can get good money, but the stuffs, the facilities... You must have facilities in order to. (Papaya and tomato farmer)

8.4.Conclusion

This chapter considered major threats to the performance and sustainability of Fiji's FV sector and different ways that value chain actors prepare for and respond to perceived risk. Although cyclones are the most transparent hazards, with clear implications for FV availability, affordability, and acceptability, FV value chains are also confronted by a number of other factors that stress the system, including ongoing political issues, land tenure insecurity, high reliance on imported agro-inputs, land degradation, risk of crop damage from insects, disease, or natural disaster. These stressors are interrelated and often amplify each other, especially in the event of a shock, such as a cyclone. For example, participants described how cyclones can lead to flooding, pest and disease outbreaks, and financial hardship, which in turn leads to reduced investment in production.

Actors across the exemplar chains described strategies to reducing risk from hazards. These include building strategic relationships with upstream and downstream actors, diversifying the range of products handled, and making capital investments. In addition, farmers described stocking seeds when they are available to improve seed access, applying agro-chemicals to bolster soil fertility and control pests, harvesting crops before they ripen to protect them from pests, and taking on additional downstream functions in the chains.

The findings suggest that value chain actors, especially farmers, take an active role in managing

risk; however, many struggle to choose the best possible approaches to doing so. Little information and support appears to be available to farmers to help them make these challenging decisions in the context of high vulnerability and strong financial and time constraints. This fosters feelings of dependence on external assistance, particularly amongst Sigatoka growers who frequently suffer considerable crop damage due to the impact of natural disasters on an already weakened agricultural system.

The next chapter discusses these findings alongside those presented in previous chapters and their relevance for FV intake in Fiji. It also considers the benefit and utility of nutrition-oriented value chain analysis for identifying possible interventions to increase FV consumption through focusing on the local supply.

CHAPTER NINE: DISCUSSION AND CONCLUSION

9.1 Introduction

In this chapter, the overall results of the research, its limitations, and merits are discussed. The aim of this study is to identify the strengths, limitations, and potential of nutrition-oriented value chain analysis to inform policy and programmes to increase FV intake in Fiji. Fiji was selected to be the site of this case study on account of inadequate FV intake (Cornelius et al., 2002; Ministry of Health, 2014), high and rising rates of diet-related disease (WHO, 2011), and strong policy commitment to strengthening FV production and promoting FV consumption (Ministry of Health, 2010a; Ministry of Primary Industry, 2009; National FPAN Advisory Committee, 2010; NFNC, 2008b).

This chapter is divided into four main sections. Section 9.2 summarises the major findings as they relate to each of the study's four objectives. Section 9.3 considers the relevance of the findings in the context of other research. Section 9.4 critically examines the strengths and limitations of the methods, beginning with the choice of the strategic business management framework for value chain analysis and its adaptation for nutrition, then considering the overall research design and each specific research method. Section 9.5 considers the relevance of the research to public health policy and possibilities for future research. Possible areas for policy action are suggested; however, given the aims and objectives of this thesis and the exploratory nature of the research, no attempt is made to offer specific recommendations for policy or programming. Finally, Section 9.6 provides a brief conclusion to this thesis.

9.2 Summary of principle findings by research objective

9.2.1 Objective 1

To review the major theoretical and methodological approaches which have influenced development of nutrition-oriented value chain analysis

Value chains are the full sets of interlinked activities required to bring a product or service through the various stages of production and utilisation. They describe the process by which value is added, maintained, or lost and are used widely as an organising feature for research and development projects aimed at understanding the full chain process and improving it in some way. Three broad traditions of value chain research can be distinguished: *filière* research, strategic business management research, and political economy research (Hawkes & Ruel, 2011). Although distinct, these perspectives have been enriched through the cross-fertilisation of ideas and methods.

Filière research emerged in the 1960s as a way to study contract farming and vertical integration in French agriculture (Raikes et al., 2000). It involves mapping product flows and identifying the actors and activities within a chain or ‘*filière*’, and has been widely used in francophone developing countries to examine how public policies and institutions contribute to the smooth flow of agricultural commodities (Bockel & Tallec, 2005; Raikes et al., 2000). Research falling under the ‘*filière*’ heading is broad; there is no specific theoretical or methodological footing and *filière* analysts apply a range of qualitative and quantitative methods. The common feature is the use of a *filière* (chain) as the basis of the analysis (Raikes et al., 2000).

Within strategic business management, value chain analysis is used to assess the performance of a chain relative to its ability to create value for consumers and generate profit for chain actors. It draws from SCM and principles of lean management, which emphasise the importance of integration of activities and processes within and between firms in a chain (Simons et al., 2003). The underlying premise is that greater integration across the chain will give rise to better decision-making and resource allocation, and when a well-integrated chain organises around the generation of consumer value, the products and services delivered will be harder for competitors to imitate (Bonney et al., 2007; Fearne et al., 2012; Grunert et al., 2005). Value chain analysis from the strategic business management perspective is focused primarily on uncovering

bottlenecks and inefficiencies in the chain and detecting un-tapped opportunities for generating consumer value (i.e. increasing effectiveness) and thus profits for businesses (Bonney et al., 2007; Fearne et al., 2012; Heikkilä, 2002; Walters, 2006; Zokaei & Simons, 2006). Typically, a range of qualitative and quantitative (or semi-quantitative) methods are applied together to identify value from the consumer perspective; map the activities, actors, and relationships in the chain; and explore the flows of materials and information (Bonney et al., 2007; Soosay et al., 2012). It is used frequently by individual firms or sets of linked firms seeking to increase their competitive advantage.

The third major tradition – global chains research – comes from the political economy perspective and is based in world systems analysis (Wallerstein, 2004). This research perspective focuses on the examination of the causes, nature, and consequences of global industrial and technological integration (Bair, 2005; Coe et al., 2008b; Gereffi et al., 2001). Several analytical frameworks exist within this perspective, with the GVC framework being the most influential and dominant. The GVC framework is used to ask questions about how power and benefits are shared by different actors in globalised value chains, with a particular focus on understanding governance structures (Gereffi & Fernandez-Stark, 2011; Gereffi et al., 2001, 2005). GVC research is usually focused around qualitative case studies of transnational networks of firms.

In recent years, value chain analysis has been proposed to help identify solutions to challenging nutrition problems (Hawkes & Ruel, 2011) by examining how food value chains are structured, why they organise and function as they do, and how they can be leveraged for improved nutrition outcomes. Research and intervention can focus on either ‘short chains’, such as those for subsistence production and the linking of local farmers to local markets, or ‘long chains’, such as those that involve international trade and transnational food processing industries (Hawkes, Thow, et al., 2013). As Hawkes and Ruel (2011) point out, the research aims, objectives, and context will necessarily determine which value chain tradition is most suitable to draw upon.

For this thesis, which seeks to understand the underlying supply-side influences on FV availability, affordability, and acceptability in urban Fiji, the strategic business management tradition offers the most supportive research foundation. The strategic business management framework for value chain analysis focuses on identifying what consumers demand and why a chain does or does not meet that demand, and recently has been demonstrated to be adaptable to the study of agri-food chains in developing countries (Adhikari et al., 2012; Bonney, Collins, et al., 2013; Bonney, Nicetic, et al., 2013; Macharia et al., 2013).

9.2.2 Objective 2

To identify what urban Fijian consumers value in FVs

This study identified tradition, health and well-being, and pleasure and taste preferences to be critical factors motivating urban Fijians to include FV in their diets. FV are an important part of the traditional eating patterns of Fijians of both iTaukei and Indian descent. Focus group discussions indicated that traditional foods – including local FV – still are consumed commonly at home and continue to be highly valued for get-togethers, feasts, and religious festivals, but are now often combined with imported or processed foods. Traditional diets and health are commonly believed to be interrelated, with consumption of FV, particularly fresh, local FV, recognised as beneficial for health. Many focus group participants understood and described the link between high FV consumption and disease prevention and certain FV products are used in traditional medicine to treat specific ailments. Moreover, some FV are well-liked by many and often used to add flavour and colour to dishes.

Urban consumers were found to care about both product quality and price. Many urban Fijians are highly price-sensitive in their FV shopping, but low price on its own is not sufficient to motivate purchase. Consumers seek products that they perceive to be “value for money”, and define quality in terms of taste and appearance (pleasurable to eat), health properties (perceived to positively affect health), freshness (newly harvested), and convenience (easy to acquire and

prepare). Although the characteristics that consumers use to signal quality are product-specific, the look and feel of products (e.g. colour, shape, and firmness), trust in the seller, and the cleanliness of the retail facility are often important. For each exemplar product, consumers in this study had well-developed ideas of which product attributes signal the greatest quality: leaf maturity and freshness for amaranthus; variety and ripeness for papaya; and colour and size for tomatoes.

The interrelated factors of availability and price were identified by urban Fijians as key constraints to FV consumption. Supplies of local FV products were described as irregular and subject to seasonal variability, with elevated prices during periods of shortage. Substitutions within the FV food group are common and urban Fijians often use imported fresh FV and processed FV to supplement local supplies. For example, tinned tomatoes and imported fruits (e.g. apples) have become staple foods for many urban families due to their ubiquitous availability and relatively stable prices.

9.2.3 Objective 3

To map exemplar FV value chains, and identify the value chain activities and actors

In this research, three exemplar product chains were used to study distinct forms of FV value chains supplying the Suva-Nausori market. Figures presenting the major activities in the exemplar chains are presented in Chapter Six.

The amaranthus exemplar chain provides an example of a peri-urban value chain for a highly perishable FV product. Most amaranthus supplied to the urban target market is produced in the corridor between Suva and Nausori. Commercial production of the perennial crop is highly dependent on manual labour and agro-chemical inputs. Farmers harvest the crop at both young and more mature growth stages to target different consumer segments. The chain is often vertically integrated, with farm families producing and retailing to consumers in markets or by

going door-to-door. Some amaranthus supplies are also wholesaled by farmers and retailed by middlemen.

The papaya exemplar chain encompasses production in the Sigatoka Valley through retail in Suva-Nausori and offers a unique example of the local chain for a product that is promoted strongly for export. Planted in large stands, the crop requires significant resource investment (seedlings, agro-chemicals, water, and labour) over a period of approximately nine months before bearing fruit. Plants continuously produce papayas and harvesting can extend over several years. Fruit that are not selected for the high value export and tourist markets are transported to local urban markets by farmers or rural middlemen, who wholesale to market middlemen for retail to urban consumers.

The tomato exemplar chain also covers production in the Sigatoka Valley region through retail in Suva-Nausori. Large-scale production of tomatoes occurs throughout the region and growers who produce tomatoes also grow a range of other FV (including papaya). This exemplar chain therefore is illustrative of value chains for seasonal FV grown in the Sigatoka Valley and sold in Suva markets. Limited off-season production means that local availability and affordability of tomatoes varies substantially during the year. As with papaya, farmers and rural middlemen transport the fruit to market, where it is bought by market middlemen and re-sold to consumers.

9.2.4 Objective 4

To identify why the exemplar value chains are organised and function as they do, and how this contributes to product availability, affordability, and acceptability

Value chain actors are small business owners and motivated to maintain or grow their incomes.

Across the three exemplar chains, actors demonstrated a reasonable understanding of the product characteristics valued by urban consumers and acknowledged that their actions can have important implications for product quality. However, they view urban Fijians as highly price-

driven and thus, when faced with trade-offs between cutting costs and engaging in activities that add value for consumers, FV value chain actors often choose to focus on price minimisation. For example, when supplies are ample, farmers sometimes choose not to grade their tomatoes and papaya because they do not anticipate local buyers will pay more for higher grades. This has important positive implications for FV affordability, but can negatively affect the acceptability of products available in local urban markets.

Decisions made by actors in FV value chains are limited by their resources, skills, and knowledge, and by the broader agricultural business environment. Across the exemplar chains multiple bottlenecks and barriers to the smooth flow of materials and information were identified, and a range of vulnerabilities to ecological, economic, and political forces were revealed. These are reviewed below sequentially by value chain function.

9.2.4.1 *Input supply*

Serious bottlenecks were identified in the seed supply for tomatoes and papaya. Importation of hybrid seeds, which are preferred for the production of tomatoes and some other vegetables, is dominated by one major private sector supplier. Due to its unique and critical role, business failure (or voluntary termination) of this supplier would seriously harm the volume and quality of tomatoes (and some other FV varieties grown using hybrid seeds) available locally. The development of a competitive market for hybrid seeds is limited by Fiji's small size, the complex nature of international seed trade, and the need for importers to have high financial assets and well-developed networks of overseas suppliers.

In contrast, all papaya seedlings are produced locally, primarily by the Department of Agriculture and Taiwan Technical Mission. However, demand for seedlings regularly exceeds supply, thereby constraining local papaya production. Expanded seedling production is limited by financial resources and a shortage of skilled professionals in seed selection and germination.

High agro-chemical and fuel prices were described by farmers across the three exemplar chains as major challenges to the production of large quantities of high quality, low cost FV. Although agro-chemicals are under price control, farmers believe prices to be rising in real terms. In an effort to reduce spending, many farmers limit their agro-chemical use or select cheaper (and possibly inferior) alternatives. These strategies were acknowledged by farmers in interviews and workshops to adversely affect the quality and quantity of FV produced. Whilst payment systems for agro-chemical inputs aimed at smoothing expenditures are not uncommon for papaya and highly praised by farmers as supportive of production, they remain unusual for products targeted to local urban markets, such as tomatoes and amaranthus.

9.2.4.2 Production

Two important and interrelated issues facing the FV sector are access to land and maintenance of a robust farm workforce. Most of the land on which FV are produced is not owned by the farmers who operate it, and is instead rented on 30 year leases. Actual and anticipated non-renewal of leases is a leading cause of migration out of rural areas. For those families that do renew their leases, loss of family labour as younger generations leave the farm to pursue education and employment elsewhere was a commonly mentioned concern. Labourers often are hired to supplement family labour, but farmers in this study said this can be straining financially and felt that hired labourers are less reliable and lower skilled than family members. For these reasons, farm businesses that lack sufficient family labour sometimes scale back the land area cultivated or switch to less time-intensive crops, such as roots and tubers, with clear potential implications for FV quantity and cost in local markets.

Declining soil fertility was another challenge identified to Fiji's FV sector. The present study found farmers cultivating the land continuously or with only short breaks, and frequently disrupting soils through tilling. As noted above, commercial production is heavily dependent on agro-chemical inputs. Land tenure insecurity was one suggested contributing factor, with farmers

on leases thought to take a shorter-term perspective to land management. Lack of knowledge and cost pressures on farmers also were believed to contribute to the challenge.

Natural disasters are an ongoing threat to FV production and value chains. Immediate impacts include a drop in supply and accompanying price spikes in local markets and an elevated risk of pest and disease outbreak. Most farmers have modest incomes, little savings, and low levels of capital, and thus require continuous earnings to maintain their operations. Therefore, natural disasters or other events that damage supply or disrupt work can have enduring implications on production. In addition, low levels of savings make it difficult for farmers to invest in technologies, such as nurseries and drainage systems, which could reduce the vulnerability of their businesses to natural disasters.

There is no strategic production planning across the FV sector and farmers determine what they will grow based on their historic production, what they see others planting, or what they have informally heard is selling for a high price. Information about price or demand is acquired informally through discussions with buyers or other farmers. Most Sigatoka farmers in this study do not secure a market for their products before production and instead wait until harvest to call various potential buyers and check their interest and prices offered. For amaranthus, most farmers sell directly from their own stalls or have well-established relationships with vendors for whom they specifically produce the crop.

The research and extension system was found to be primarily focused on supporting production for export and the tourist market, with less attention to production for local consumers. Whilst efforts are continually being made to link farmers to the export and tourist markets through workshops, demonstration farms, and other extension activities, fewer training opportunities appear to be available to help farmers who focus on local markets to enhance their farming and post-harvest handling practices. Despite FV production distributed around the country, the

majority of investment and attention appears to be focused on the Sigatoka Valley, thus overlooking the potential of other growing regions (e.g. the Suva-Nausori corridor) which may be more resilient to natural disasters. Moreover, little formal information is available to farmers on local market prices, demand, and trends, thus impairing their ability to select the most suitable FV varieties and align their production and post-harvest activities to meet demand.

9.2.4.3 Transportation

This study found farmers to play a primary role in transportation. Amongst Sigatoka farmers, lack of trust in rural middleman, combined with the desire to build personal relationships with vendors motivates many to bring their own crop harvests to market. This is an inefficient use of both time and financial resources, as it cuts into the time farmers have available to spend on farming activities and means multiple partially-full trucks travel from the Sigatoka region to Suva-Nausori daily. Amongst peri-urban amaranthus growers, vertical integration of all chain activities from primary production through retail is a common strategy to capture a greater portion of the consumer dollar and is facilitated by the short distance between farms and market.

Poor transportation links were identified as a major obstacle to the timely delivery of high quality, fresh produce from the Sigatoka Valley; however during the fieldwork period a major road improvement project was underway on one side of the Sigatoka River. Several farmers and rural middlemen described uneven rural roads as a cause for product damage, which was compounded by the use of suboptimal packaging materials. For example, tomato and papaya farmers use wooden boxes rather than plastic crates as a way to cut costs, despite acknowledging their inferior ability to protect fruit in transit.

9.2.4.4 Markets

In Suva and Nausori, regional wholesale markets operate from about midnight until dawn, Monday to Saturday. Farmers and rural middlemen set out FV supplies to sell as commodities by the box, bag, or bundle. Vendors who pre-order FV can avoid visiting the wholesale market and

have supplies delivered straight to their stalls by farmers when the market opens. However, those vendors who buy all or some of their supplies through the wholesale market emphasised that arriving early (i.e. before 05:00) was important to acquire the best products.

At markets, vendors regularly struggle to manage FV supplies efficiently, as storage facilities are not available (neither refrigerated nor unrefrigerated) and new stock cannot be purchased during the day due to the restrictive wholesaling hours. FV are kept on tables or mats in the open air until purchase and many vendors operate at stalls that lack overhead coverage, thus exposing FV to the sun and other natural elements. Together, these conditions can lead to imbalances in supply and demand, substantial product loss, and rapid deterioration in quality. Price reductions are used often in an effort to ‘move’ excess or depreciated FV supplies.

9.3 Relevance of findings

This is, to the PhD candidate’s knowledge, one of the first nutrition-oriented value chain analyses which explicitly adopts the strategic business management model, and the first application of nutrition-oriented value chain concepts to Fiji. This thesis aimed to make conceptual and methodological contributions to inform future research in this emergent area, as well as generate new information on Fiji’s FV system that could be used to inform policy-making and programme design. Despite widespread recognition that FV access (encompassing availability and affordability) is a key barrier to consumption for low-income households worldwide (Kamphuis et al., 2006; Ruel et al., 2005), and that providing consumer information alone is insufficient to address poor diet, but instead must be complemented by changes to food environments and food systems (Hawkes, Jewell, et al., 2013; Nugent, 2004; Story et al., 2008; Swinburn et al., 2011), comparatively little attention has been paid to the upstream forces shaping the FV supply. Therefore, the key contribution of this thesis has been to demonstrate the potential for the strategic business management model of nutrition-oriented value chain analysis to shed light on the factors in the food supply that influence FV demand and consumption.

The research responds to calls for more evidence regarding the factors underlying poor dietary patterns in the Pacific Islands (Snowdon, 2011). In Fiji, demographic, epidemiological, and nutrition transition has been rapid (Coyne, 2000; Hughes, 2003; Parkinson, 1990; Schultz, 2004; Thaman, 1990) and data and evidence gaps hamper efforts to address public health challenges (Snowdon, 2011). For diet, this includes a dearth of evidence on the FV supply. The failure of food balance statistics to account for the country's substantial subsistence production base limits their utility for answering questions on FV. Moreover, whilst Department of Agriculture collects supply and price data weekly, this data is subject to measurement limitations.

This study's findings related to FV demand compare well with and extend previous research in Fiji and global evidence on the importance of price to the FV decision-making of poor consumers (Kamphuis et al., 2006; Ruel et al., 2005). Policy stakeholders involved in Snowdon's doctoral research (2009) identified high cost, poor availability, low knowledge, and preferences for other foods to be barriers to FV intake amongst the general Fijian population. For staples (e.g. roots, tubers, rice, bread) and high-protein foods (e.g. meat, legumes), Owen and Vatucaawaqa (2002) found perceived 'value for money', convenience, and preferences to be main factors influencing consumption. This present study contributes new information by yielding in-depth insight into the drivers of FV consumption for urban Fijians and the specific product attributes they demand. Whilst FV price is critical to food choice, product quality also matters and making supplies available and affordable will not be enough alone to increase intake. Failure to take consumer motivations and demands into account – even in a relatively poor country – reduces the chances of success of any intervention to increase consumption.

Concerns with Fiji's food security are recurrent and are interrelated with concerns over ecological, political, and economic vulnerability. Fiji's small size and geographical location make it vulnerable to natural disasters, including those associated with global climate phenomena which may change in magnitude and frequency (Landsea, 2000; UN-OHRLLS, 2014). Tropical

cyclones often cause direct and immediate losses to crops and soil; however, there are also less direct, but nonetheless considerable losses through damage caused by severe river flooding and outbreaks of pests and disease that follow major cyclones. During the eight months of fieldwork for this PhD, each of these forms of ecological damage was observed. In addition to disrupting food security, natural disasters have a devastating impact on Fiji's economy. In fact, between 1998 and 2009, physical exposure to storms is estimated to have cost Fiji 24% of GDP (IPCC, 2014).

Some scholars have suggested that traditional farming patterns and food systems that formerly mitigated the adverse impacts of shocks are not as strong as in the past (Foraete, 2001; Thaman, 1990). Traditional agriculture included discontinuous cultivation with long fallow periods and growing products without chemicals and with minimum tillage. Gardens were surrounded by bush, which acted as a windbreak, reducing the rate of evapotranspiration and mitigating soil loss from natural disasters (Foraete, 2001). Wild plants and animals from the forests, rivers, and oceans were an integral component of these food systems, as were traditional food exchange networks and preservation practices (Thaman, 1990). The present study found FV farmers often cultivating the land continually, with high levels of agro-chemical use and tillage. In the event of a cyclone, it was not uncommon for entire large fields of crops to be destroyed. Whilst many focus group participants described the continued importance of food sharing, they also discussed shifting to more processed and imported foods after natural disasters.

Previous research has identified a link between modern cropping practices in Fiji and depletion of soil resources, with major problems relating to low levels of soil fertility, low levels of organic matter, poor water-holding capacity, and declining productivity (Fink, Neave, Hickes, Wang, & Nand, 2013; Foraete, 2001). Recent soil analyses in the Sigatoka Valley region have identified soil health to be 'moderate' (mid-way between poor and good) (Fink et al., 2013). In the present study, awareness of soil degradation was high amongst input suppliers, but infrequently discussed

by farmers, suggesting a need to increase awareness and dialogue on this issue, as well as train farmers in soil management. During the fieldwork, at no time was the PhD candidate made aware of skill training taking place on this topic.

The challenge of expiring agricultural leases identified in the present study has been repeatedly recognised by the Government of Fiji and development partners. Between 1997 and 2007, 7,341 agricultural leases expired, of which 57% were not renewed and reverted to the indigenous landowners (ADB, 2009). In recent years, attention to this issue has led to changes in laws and leasing arrangements (Dodd, 2012) and several development projects aimed at helping tenant farmers whose leases were not renewed find alternative employment or new farms (AAACP, 2011; ADB, 2009).

Once self-sufficient in food, Fiji is now increasingly reliant on imports of fresh and processed foods. For over a decade, Fiji has had a trade deficit, with food a leading import and export (FIBoS, 2014). The unfavourable trade situation increases the susceptibility of the food supply and the economy to global political and economic pressures. The Department of Agriculture has responded to trade vulnerability by focusing its policies and programmes on import substitution and export promotion (Ministry of Primary Industry, 2009). Import substitution activities have included initiatives to promote local potato, rice, and livestock production and to supply FV to tourist markets. Fiji's tourist industry pays high prices for superior FV, but has historically preferred to procure products from importers, who are viewed as better able to meet their demands for quality, volume, and service (Young & Vinning, 2007). Some resorts, especially those on the smaller islands, choose to grow their own organic FV and use it as a selling point for visitors. From an economic perspective, accessing tourist markets provides a strong opportunity for income generation and import substitution, thus motivating Department of Agriculture and their development partners to focus on this area (Ministry of Primary Industry, 2009; Young & Vinning, 2007).

However, corroborating previous research by Snowden (2009), this study identified a potential conflict between efforts to optimise FV exports and sales to tourist markets and the provision of adequate supplies and prices to the local population. It is possible that the strong focus on the export and tourist markets has resulted in neglect of local marketing systems. This research found few differences in Fiji's urban marketing infrastructure for fresh, local FV than that observed by Baxter 35 years ago (Baxter, 1980). The fresh food market remains the most important source of FV and transport links for farmers continue to be a major challenge. As in the past (Baxter, 1980), FV are wholesaled as commodities, stored at stalls in ambient conditions, and sold in a 'loose' form. In line with recent research by Stringer (2011), the findings of the present study suggest considerable scope for improving the FV supply by updating this infrastructure to reduce FV wastage and support greater product differentiation. It is also likely that the focus on promoting non-local markets impacts the quantity, quality, and prices of the FV supply available to the local population by encouraging farmers to produce different products and creating competition for supplies.

The promotion of FV export markets also has had some positive externalities for local consumers, as products that do not meet the exacting requirements of exporters often enter the local FV supply. For example, 'Hawaiian' papaya is available to Fijian consumers – often at affordable prices – as a result of the development of the papaya export industry. A similar situation has been observed in Tonga with the squash export industry, as misshapen gourds are rejected from export and end up in the local market at a low cost. However, these squash are not acceptable to Tongans, and primarily are used as livestock feed or consumed by the small local Japanese community (Yoshihara, 2010), suggesting that the development of a successful FV export industry does not necessarily lead to benefits for nutrition for the local population.

Over ten years ago, Bachman (2001) conducted research with vegetable farmers in the Sigatoka Valley to identify the major business challenges they face and possible solutions. Farmers in his

study identified high agro-chemical costs, poor seeds, disease threats, lack of irrigation, low prices from middlemen, and problems identifying a market to be major challenges and suggested both agricultural improvements (e.g. crop rotation) and Government intervention (e.g. introduce subsidy, supply inputs directly, introduce price controls) as possible solutions. Since, other studies on FV production in the Sigatoka Valley have identified similar constraints to farmers (Fink et al., 2013; Young & Vinning, 2007). The findings of the present study align with the findings of these earlier studies and reveal that Fiji's vegetable farmers continue to struggle with the same issues and expect greater support from the Government. However, the findings also provide new information on how farmers cope and manage these issues, for example by selecting the cheapest inputs and taking their own produce to market. Critically, farmers in this study did not feel adequately supported in making challenging production and marketing decisions and many felt overlooked by the Government extension services designed to advise on these issues.

Across the Pacific Island countries, seed availability, accessibility, and suitability have previously been raised as serious limitations for agriculture (Bachmann, 2001; Fink et al., 2013; Pole, 2009; Young & Vinning, 2007). Good seeds are those that are healthy and possess the desirable properties that farmers need (e.g. high yielding, resistances to diseases, pests, and environmental stressors, produce fruit durable to travel) and consumers demand (e.g. produce large, bright-coloured, evenly shaped fruit). The findings of this research highlight that variety matters for local populations, as varietal differences contribute to urban consumers' quality perceptions.

In line with the value chain literature (Bonney et al., 2007; Soosay, Hyland, & Ferrer, 2008; Womack & Jones, 2002), the present study found the businesses most efficient and effective at delivering value to consumers to be those imbedded in highly integrated and collaborative chains, often linked through family ties or long-held business associations. However, in many instances, value chain actors were found to behave in opportunistic ways and poor relations between farmers and rural middlemen were identified to impede collaboration that could potentially

increase efficiency and effectiveness of the local FV supply. A need for greater collaboration in Fiji's FV sector has been suggested previously to improve performance. For example, in 2009, a scoping study was carried out to assess interest in the development of a collection centre for fresh produce in the Sigatoka Valley that could provide cool storage, grading, and packing facilities, as well as community services, such as training, input distribution, and sharing of market information (Veit, 2009). Based on findings of a survey with farmers and rural middlemen, that study concluded that despite the potential benefits of a collection centre for the FV supply, many buyers would continue to seek supplies direct from farmers and farmers would sell to the highest bidder, thereby distorting competition and undermining the centre's success (Veit, 2009). Together, the findings of the present study and that research suggest further consideration is needed of how sustainable relationships can be developed, such as increasing information asymmetry in the chains. Lack of trust and a tendency to seek cost-savings rather than revenue-enhancing opportunities is a major barrier to improved collaboration (Spekman, Kamauff Jr, & Myhr, 1998)

The findings of this study show similarities to those of other studies applying a strategic business management framework to investigate fresh FV value chains in developing country settings (Adhikari et al., 2012; Birch et al., 2011; Bonney, Nicetic, et al., 2013; Bonney, Palaniappan, et al., 2011). Common challenges identified in such chains include insufficient infrastructure; lack of economies of scale due to each smallholder trading his or her crops independently; and poor chain relationships characterised by opportunism, low or no commitment, and sometimes exploitative behaviour. The present study adds to this research area by considering how these challenges may have implications for nutrition and health.

9.4 Strengths and limitations of the methods

The strategic business management model of value chain analysis applied in this thesis provided a framework for understanding the factors motivating decisions taken between farm and market in

Fijian FV value chains. Fiji's domestic FV sector was an ideal prototype for trialling the framework's applicability to nutrition, due to the FV food group's accepted importance to health and the potential health and economic benefits of development of the sector. However, the adoption of an explicit nutrition-orientation was a significant shift in focus for the framework. This section explores the major adaptations made to the strategic business management model to enhance its suitability for investigating Fiji's FV sector from a nutrition perspective. Following this, the strengths and weaknesses of the overall research design and each individual method are discussed. Given that this is one of the first applications of the framework to nutrition, it is important to document the experience of implementing each aspect of the primary data collection.

9.4.1 Adaptation of the strategic business management framework of value chain analysis

The strategic business management approach to value chain analysis – as originally conceived and developed – focuses on the collection of rich, detailed information on specific interlinked businesses with a goal to find opportunities to optimise effectiveness through innovation either in the chain processes or in the final product (i.e. upgrading). To adapt this approach to nutrition and to the study of Fiji's FV sector required consideration of three important characteristics.

First, people eat whole diets, not just specific foods produced through specific value chains (Hawkes & Ruel, 2011; Lang & Heasman, 2004), therefore, from a nutrition and health perspective, there is an imperative for developing an understanding of the agri-food sector at large rather than focusing narrowly on a single chain. However, if there is evidence that a specific food, or bundle of foods (e.g. FV), can solve part of the nutrition problem of interest (e.g. low FV intake), there is a benefit to concentrating on the chains or sub-sector that deliver that product or products. In Fiji, where the FV sector is dispersed and smallholder-led, this is particularly important as value chain actors are often incorporated in multiple FV value chains in multiple capacities simultaneously and any effort to define roles in terms of single chains may preclude understanding important linkages and decisions.

Second, unlike value chains in manufacturing where the focus tends to be on assembling composite products, for fresh foods, the focus is often on maintaining value, and even in cases of adding value, the task may be removing inedible components (Taylor & Fearn, 2006). From a nutrition perspective, no processing or minimal processing is often preferred (Montiero, 2009). For example, in Fiji, keeping produce fresher longer is highly valued by urban consumers, but does not actually involve transformation of the product.

Third, the study of the agri-food systems involves the study of living (or formerly living) crops. Living materials, such as FV, are inherently unique and change continuously over time due to biological, physical, and chemical processes. Optimal post-harvest storage and handling differs by FV variety, microbial load, presence of pests, temperature, atmospheric composition (e.g. relative humidity), and stress or damage (Bengtsson et al., 2008). Activities that add or maintain value at one place at one time may be wasteful in other places or at other times. For example, best practice pest management techniques will vary between fields and seasons.

To account for these important characteristics, three major interrelated adaptations or adjustments were made to the general research framework. First, three exemplar chains were selected to be illustrative of different types of fresh FV value chains. Second, information was gathered from multiple people representing each link in each chain to capture some of the diversity in resources, skills, and constraints faced by different actors. Finally, fieldwork was carried out over nearly eight months to explore some of the heterogeneity in the chains in different seasons.

9.4.2 Adapted strategic business management framework and overall research design

A key strength of the framework applied in this thesis was its ability to identify a diverse range of bottlenecks and vulnerabilities that hinder the delivery of sufficient quantities of affordable and acceptable FV to urban consumers. The modifications made to the traditional strategic business management framework provided a more complete picture of the different types of chains supplying FV to Fiji's urban population than would have been possible through the examination

of just one or a few chains of specific interlinked businesses. The large number of challenges identified in the exemplar chains highlights the importance of taking a systematic approach to examining the production and retail system. The findings demonstrate the capability of the adapted framework to both capture and clarify the complexity of the system and suggest a benefit to the use of a small number of exemplar products. Whilst the findings are not generalisable outside of Fiji, they are highly transferable across different local value chains; for example, findings from the exemplar tomato chain also shed light on local chains for French beans, long beans, and okra, which are often produced by the same farmers and marketed by the same vendors.

A second strength relates to the inclusive character of the study design. The explicitly interdisciplinary and inter-sectoral nature of the approach may help bring together policy stakeholders who typically have little interaction. From the planning stages, officials in the NFNC and Department of Agriculture came together to offer input and support for this project, which informed the work and could potentially increase the likelihood that the research findings will be used.

The flexibility of the strategic business management framework of value chain analysis allowed the PhD Candidate to select methods suited for the context and research objectives. The mixed methods qualitative research design allowed her to collect data on different aspects of the FV supply system from different perspectives, and also supported triangulation to increase the validity of the findings (Mays & Pope, 2000; Patton, 1999). While there were a number of advantages to this approach, the case study also revealed several limitations.

First, qualitative case study research supports the identification of possible causal mechanisms, but does not permit causality to be assigned. This study struggled to incorporate more quantitative assessment of material flows, costs, and profits along the chain, due to the

considerable heterogeneity across individual value chain operations and even within single operations at different times of year. For example, the market options available to farmers are highly dependent on factors such as weather, market, and environmental conditions. Nonetheless, the research could draw insights from the *filière* tradition on how to incorporate quantification of inputs, outputs, prices, and value added in agri-food chains for commodities (Raikes et al., 2000).

Second, the research relied on a limited number of participants in each exemplar chain. It is possible that repeating the process with different groups of urban consumers and value chain actors could generate different findings. In particular, it is possible that growers in production regions with inferior transport linkages have different experiences and constraints than those in the peri-urban area or the Sigatoka Valley.

Third, the value of the findings is contingent on the FV sector's ability to act on the information. The capabilities of individual actors and the agri-food system constrain what can be done, so it is not always possible to translate consumer wants and needs into a product that meets those demands. For example, Fiji's small size inhibits the development of a vibrant, competitive seed trade and having one generally reliable importer is considered an advantage over other countries in the region (Pole, 2009). Moreover, the large number of smallholder farmers poses an additional challenge to the coordination of production and marketing, which has discouraged value chain intervention elsewhere (Bonney, Nicetic, et al., 2013).

Fourth, none of the products selected by the Local Reference Group to serve as exemplars for this study are indigenous to Fiji and there are important questions to ask about their role in the broader ecological sustainability of Fiji's food and nutrition system. The Pacific region is known for its rich biodiversity and unique edible FV variants (Dignan, Burlingame, Kumar, & Aalbersberg, 2004; Englberger et al., 2003, 2007; Taylor, 2011; Thaman, 1990), and there is a need to examine opportunities to increase the supply of and demand for indigenous crops.

According to Johns and Sthapit (2004, p. 151), “Cultivated and wild biodiversity, where it is part of traditional agricultural and food systems, can be best conserved and enhanced through rational use” and they suggest promoting conservation on farms and in home gardens, linking neglected and underutilised species to markets, and promoting both the health and ecosystem benefits provided by biodiversity.

Fifth, the focus of value addition and increased effectiveness in value chains may exclude poor consumers from benefiting from any intervention activities stemming from value chain analysis (Hawkes & Ruel, 2011). This is the case if an intervention leads to investments in quality-enhancing technology that require price increases to off-set spending, or greater differentiation in which differentiated products are more costly than those sold in bulk through the wholesale market. In Fiji, the research identified a clear tension between the higher prices desired by value chain actors and the lower prices considered affordable for poor consumers. However, value chain development does not necessarily imply the provision of a more expensive product, particularly when availability, affordability, and acceptability issues are solved through enhanced coordination in the chain. Moreover, if an intervention adopts a truly consumer-oriented notion of value, willingness to pay may actually increase (Hawkes & Ruel, 2011). At the most fundamental level, what sets nutrition-oriented value chain analysis apart from other applications is its explicit focus on nutrition; therefore, all potential interventions must be considered in light of what they will offer (or take away from) nutrition.

Finally, a key challenge to the usefulness of the approach is its reliance on an independent, external researcher. This person must have the necessary technical research competencies, the ability to look across the chain, and the interpersonal skills to raise awareness of the bottlenecks and potential solutions with both value chain actors and policy-makers (Taylor, 2005). To date, most published case studies have employed independent consultants or academics to complete the research. In value chains for nutritious foods – particularly chains in developing countries –

resource limitations constrain the feasibility of employing outside assessors, and there is a need to train local staff to lead these sorts of studies. In this research project, training of local team members in each aspect of the data collection and analysis was used to build capacity to carry out this sort of work in the future.

In this project, the support and sociolinguistic competence of the local team members was essential at all stages of the research. During data collection, transcription, and coding, the RAs and local counterpart served as ‘cultural brokers’ (Hsin-Chun Tsai et al., 2004), guiding the PhD candidate on local customs and concepts and providing explanations on the data to help her contextualise participants’ comments. Frequent discussions of the research team on language meanings and usage likely contributed to improved translations of participants’ voices and enhanced interpretation of the data.

9.4.3 Consumer research

Consumer research is a cornerstone of value chain analysis in strategic business management and used to explore consumers’ perceptions of a product or product category and the attributes upon which they make their purchase decisions. In this study, the participation of a variety of urban consumers from the two major ethnic groups is likely to have been positive in increasing the range of data collected on food choice related to FV. The local co-researcher and counterpart were invaluable in identifying potential existing groups from which to recruit study participants. Seven of the eight focus groups were drawn from existing faith-based organisations and the eighth was from a women’s group. Given the strong association in Fiji between ethnicity and religion, and the role of ethnicity and tradition in diets, this approach was seen as appropriate and was felt to facilitate better comparisons between groups. The use of pre-existing groups may have supported participation and enhanced discussion; however, there is also a risk that established norms and hierarchies within the groups may have inhibited the contributions of some participants, for example younger compared to older women (Kitzinger & Barbour, 1999).

Whilst this research relied entirely on qualitative investigation of consumer value, there is scope for future studies also to incorporate quantitative research, particularly surveys which could be designed to segment consumers by their food choice behaviour and purchasing preferences (Brunsø et al., 2002; Macharia et al., 2013). Bonney et al. (2011) suggest following focus group discussions with survey research to explore the relative importance of the different product attributes identified, so as to provide a more comprehensive assessment of what consumers value. In this study, a decision was taken that collecting quantitative data on consumers to inform the value chain analysis, particularly in the low-income setting and under tight timescales for a PhD, would have diverted limited resources away from an in-depth investigation of the value chain. Consumer intercept surveys could provide one promising low-cost approach to collecting quantitative information. Data generated through intercept surveys can be used to segment consumers into homogenous sub-groups with unique food choice behaviours, and the subsequent assessment of the value chain can then focus on designing interventions that meet the differing needs of the discrete segments of consumers. This approach recently has been applied to value chain analyses of the fresh FV sector in Nepal and Kenya, with promising results (Adhikari et al., 2012; Macharia et al., 2013), where researchers found different segments to have distinct demographic characteristics and preferences for quality and customer service. This suggests value chain interventions will have different influences on different consumer groups, and allows policy-makers and programme designers to target interventions to generating the greatest benefit for disadvantaged populations.

9.4.4 Mapping workshops

Participatory mapping workshops are a common early-stage data collection method in value chain analysis (e.g. Simons, Francis, Bourlakis, & Fearn, 2003; Taylor, 2005) as they can quickly capture a considerable amount of information on the chain and encourage stakeholder engagement (Cornwall & Jewkes, 1995; Rother & Shook, 1998; UNIDO, 2009). As described in

Chapter Four, the PhD candidate implemented two distinct forms of mapping activities conducted via a series of workshops. In the first workshop (‘basic systems mapping workshop’), a group of Government stakeholders was convened to outline the basic structure, major functions, key actors, and most important supporting institutions in the chains supplying Suva-Nausori with the exemplar products, for the purpose of identifying the specific chains that would be the subject of further investigation. Following this, actors in the exemplar chains were convened for a series of ‘detailed mapping workshops’ to collect information on the specific activities occurring between farm and market in each exemplar chain and to begin to illustrate some possible challenges to the smooth flow of materials and information. The experience implementing each type of workshop is described separately.

Basic systems mapping workshop. Identifying the broad value chain maps for each exemplar product required an experienced, multi-sectoral group, and participants needed to be knowledgeable about the sector. One of the main challenges in the workshop group related to differing levels of experience and seniority, which hindered the depth of information some participants were able to contribute.

The mapping method applied in this step was adapted from the USAID template for creating a ‘basic map’ of a value chain (MicroLinks, n.d.). The stakeholders were able to undertake the mapping without difficulty, suggesting a benefit to the use of a multi-stakeholder group for generating basic maps and supporting the selection of exemplar chains. A further benefit was the active engagement and participation of the stakeholders in the research process. These stakeholders also were involved in suggesting potential participants for the more specific value chain actor mapping workshops, interviews, and observations,

Detailed mapping workshops. The second series of mapping workshops were held with actors specific to each exemplar chain. The quality of data collected in these mapping workshops was

enhanced through the use of a pilot workshop, which helped refine the recruitment technique and the structure and moderation style used in the session.

Balancing research needs with value chain actors' availability led to some challenges related to group size and composition. FV value chain actors were extremely busy and few had time to participate in a group session, particularly as some travel was required and no incentives were offered. For the papaya and tomato workshops it also was not possible to include participants representing all value chain functions, due to the substantial distance between production and retail sites.

The planned mapping process was organised around the 'current state' mapping template created and advanced by Rother and Shook (1998) and Womack and Jones (2002). This template was developed initially to examine a single, specific set of linked firms and was devised for the manufacturing context. As such, it was found to lack the flexibility to capture the heterogeneity and uncertainty of the exemplar FV value chains and participant responses did not fit well into the template's pre-defined boxes. This meant that the workshop sessions had to be adapted to use the mapping process as a tool for eliciting discussion on the structure and operation of the exemplar chains rather than generating comprehensive maps. The workshops also provided an opportunity to gather information on material flow, information flow, and relationships in a group context. Ultimately, some of the richest data on *why* the chains are organised and function as they do came from the workshops, when participants challenged each other on the reasons for doing what they were doing in their operations. Key issues raised in the workshops were later explored more fully in in-depth interviews or observations.

It is relevant to highlight that the workshops were not conducive to sharing sensitive business information (Hennink, 2007). Several times minor tension arose around certain topics, such as the resources different participants had at their disposal (e.g. income, family labour, time). In

some instances, participants used the follow up meeting held with the researcher to offer differences of opinion or approach they had with other workshop participants but were not comfortable sharing in the group setting. This suggests a benefit to collecting both group and individual data on the value chain.

9.4.5 Interviews and formal observations

Interviews and observations are central to the strategic business management model of value chain analysis and are used in virtually all studies of this type, including this one. Combining, semi-structured interviewing and observations provided a strong vehicle for exploring the underlying reasons *why* the chain is structured and functions as it does. This complemented other activities (e.g. mapping) which sought to determine *how* the chain works. The flexible nature of these methods also allows the researcher to take an iterative approach to data collection and explore new topics as they emerge (Bryman & Burgess, 1994). Combining formal observations with in-depth interviews helped the researcher to develop a broader understanding of the activities and relationships discussed and also meant processes observed could be probed in interviews.

Despite reluctance by several value chain actors to participate in the mapping workshops (usually related to availability constraints), most people invited to be interviewed or observed accepted. Unsurprisingly, rural middlemen were more difficult to engage than most other groups and only three participated in interviews. One rural middleman initially agreed to take part in an observation, but later gave constraints on what he was willing to let the PhD candidate observe. Future research should work to increase representation of this critical value chain link.

Of note, farmers in Sigatoka often were guarded in speaking about the Government. In several instances, farmers said they did not want to be asked about the Government – in particular the Department of Agriculture – out of fear that they could lose access to services or suffer in some other way. This was understandable given the ongoing political issues in Fiji and the belief held

by several Sigatoka growers that the extension service offers resources only to favoured farmers. However, in the Suva-Nausori corridor, where many farmers felt completely overlooked by the extension service, participants often were more open with their opinions about the Government.

9.4.6 Informal field observations

In addition to formal data collection, the PhD candidate regularly conducted informal market surveys and visited production areas both individually and accompanying Department of Agriculture staff members. These field visits provided critical understanding of the context within which the chain operates, the mechanisms that generate published statistics on the agricultural sector, and the sorts of information value chain actors are willing to share with and without a Government employee present. For example, in some instances camaraderie between a Department of Agriculture employee and a value chain actor elicited rich discussion, whereas in others, his or her presence limited the conversation.

Due to Fiji's small size and the limited number of actors involved in the FV sector, the PhD candidate became well-recognised amongst chain actors during the fieldwork period and developed trust with many through these casual interactions. This was invaluable in recruiting participants, as the PhD candidate often had some understanding of a person's business before discussing possible participation and the potential participant frequently had some familiarity with the researcher. This may have also helped to elicit more honest and open responses during interviews.

Finally, informal interactions with extension officers, farmers, vendors, and consumers also were essential for developing the vocabulary needed to effectively carry out the research and interpret the results. For example, the term "middleman" is used differently and sometimes ambiguously to describe any commercial actor in the chain who handles produce they did not grow. This created confusion early in the data collection, but was clarified through informal discussions and observations. In later data collection, an effort was made to clearly distinguish the type of

middleman being discussed. Moreover, a range of terms are used to describe most FV products and it was through casual discussions that the appropriate vocabulary was developed.

9.5 Policy perspective and further research

This thesis was undertaken to answer two important questions for public health. First, what are the underlying drivers of FV consumption in Fiji? Second, can nutrition-oriented value chain analysis help provide evidence to inform public health action on this topic?

Prior to this research, up-to-date information was not available on FV value chains serving Fiji's local population. Despite evidence of low FV intake (Cornelius et al., 2002; Ministry of Health, 2014), little was known about what local consumers demanded in FV, how the current supply met their needs, or the supply process. Whilst the local supply was well-known to be subject to irregularities and price fluctuations, the reasons for this had not been explored.

There is a need for increasing the evidence on how agri-food systems interact with nutrition and health. For example, how do agri-food value chains reinforce, challenge, or undermine efforts to promote healthy eating? Methods are beginning to emerge to address this, with nutrition-oriented value chain analysis currently amongst the most promising (Hawkes et al., 2014).

9.5.1 Policy relevance of the findings

This research developed new knowledge in terms of identifying clear problem areas in Fiji's FV sector affecting local availability, affordability, and acceptability of FV in urban markets. It built upon previous research by Snowdon et al. (2010; 2008) to develop an evidence base that supports Fiji to identify a range of targeted interventions which could potentially have the most impact on diet-related diseases.

At the time of writing this thesis, Fiji was in the midst of a major political shift, with the resignation of the commander of the military government and plans for the implementation of a new constitution and democratic election in the upcoming months. It is not clear how this will

hamper or facilitate local stakeholders' consideration and utilisation of the findings, which will depend on the political priorities given to the agriculture and health sectors. However, the willingness of both the Ministry of Health and Department of Agriculture to support the study provides an important precedent for future research exploring the linkages between agriculture and health and the potential for consequent evidence-based policy.

A key lesson for nutrition policy is the importance of promoting FV products individually based on their unique characteristics. Nutrition and public health often treats FV as a homogenous dietary group, which is in contrast to how agricultural policy develops FV production and marketing, with specific products considered independently based on growing conditions, market demand, and market potential. This research found product-specific information to be important at all levels of the value chain, with actors articulating distinct activities and challenges in each product's value chain and consumers seeking different attributes in different products.

The findings of this research suggest five broad areas of possible policy action. First, there is a need to improve information flows in order to better match supply and demand. Most value is added to the exemplar products before transport to market and they are traded as commodities on the wholesale market. For this reason, it is critically important for growers and agro-input suppliers to know about purchasing and consumption behaviour in relation to preferences for specific products, so that they may choose varieties with consumption characteristics which are highly valued and make production, harvest, and handling decisions that align with consumer demand (within the scope of what is feasible). It is possible that the simple presentation, grading, and quality control procedures in local FV value chains are becoming increasingly unsatisfactory to urban consumers as their incomes rise and they demand better quality, thus suggesting an untapped opportunity for product differentiation.

Second, there is a need for local policy action to encourage greater collaboration amongst chain members. This study found vendors involved in committed business relationships to be able to offer more consistent supplies with more stable prices than those who engage on the spot market. In value chains, collaborative engagement is considered the cornerstone of achieving sustainable competitive advantage (Bonney et al., 2007), as upstream actors are believed to benefit from committed partnerships by allocating their resources more productively and reducing costs through more effective planning; and downstream actors – most importantly consumers – benefit from increased influence over suppliers (Fearne et al., 2012). In FV value chains in Fiji, efforts to increase understanding of the business benefits of collaboration should be considered, as should actions to address lack of trust between farmers and rural middlemen and to increase equity in transactions.

Third, the high importance of FV price to consumer decision-making suggests some form of pricing policy could be helpful. Ex ante and ex post evaluations of the impact on FV intake of policies and interventions to reduce FV prices indicate a small benefit, but have focused on US and European populations (Andreyeva, Long, & Brownell, 2010; Thow, Jan, Leeder, & Swinburn, 2010; Tiffin & Arnoult, 2010; Veerman, Barendregt, & Mackenbach, 2005). It is likely FV price reductions would have a greater impact for health and nutrition in poorer settings, such as Fiji, as demand for food, particularly FV and animal-source foods, is more responsive to changes in price in lower income than higher income countries (Green et al., 2013; Seale Jr. et al., 2003). In Fiji, this is particularly the case after disasters or at certain times of year when prices for all FV products are elevated and consumers report reducing purchases to stay within their budget constraints. When only certain products are more expensive (e.g. during off-season for tomatoes), consumers regularly substitute within the FV food group.

Fourth, there is an opportunity for Fiji's public health and nutrition community to enhance its programmes aimed at increasing FV intake by promoting the dimensions of FV found in this

study to be important to urban consumers. Hawkes and Ruel (2011) argue that value chain approaches to improving nutrition must include interventions that not only improve the supply of nutritious foods, but also those that increase demand for such foods. The findings of this research show that perceptions of product quality matter to urban Fijians and that they are interested in foods that they perceive to taste good, benefit health, be quick and easy to prepare, and be fresh. Thus, improving the appearance of product freshness at markets and offering consumers better information about the product characteristics that matter to them – including nutrition information, but also information that provides confidence in food safety and helps increase the pleasure and satisfaction – may improve consumption of FV and consumer health.

Finally, the findings highlight a compelling and urgent need to address vulnerability in the FV sector, which is likely to have important benefits for the consistency of FV availability, price, and quality in local markets and therefore consumption. Farmers, retailers, and input suppliers in the FV value chains need greater opportunity to develop the necessary knowledge, skills, and resources to make their businesses more resilient to natural disasters and other system stressors. Infrastructure development along the chain to extend the growing season of seasonal crops (e.g. greenhouses), offer protection from natural disasters (e.g. drainage systems), and reduce post-harvest losses and deterioration (e.g. sealed roads, better packaging materials, cool storage facilities at markets, overhead coverage for vendors) is one important area. Another is raising awareness and skills in less resource-intensive production methods and sound soil management, which could reduce dependence on imported agro-chemical inputs and preserve soil qualities. Nauru provides a stark cautionary tale of the ecological limits of small island states and dangers of resource depletion (Gowdy & McDaniel, 1999), including dangers to nutrition and health (Keke et al., 2007). However, it is important for the Government and development partners to consider holistically how different strategies to develop FV value chains could influence diets and health and to select options that will support value for nutrition, as well as economic value for

chain actors. For example, it is possible that investments in infrastructure could raise prices in local markets making FV less affordable to the poorest consumers or that encouraging farmers to diversify their product mix could lead more farmers to acquiring an export focus.

9.5.2 Potential applications of the approach and future research

There is considerable scope for future nutrition-oriented value chain research to build on the work presented in this thesis. This study examined the applicability of nutrition-oriented value chain analysis based on the strategic business management model to one discrete small island setting and one food group. It will be important to apply the framework to other settings and other agri-food sectors to confirm the utility of the approach to generating evidence to inform targeted policy and programmes. It also will be important to follow up this research in Fiji at a later date to ascertain if the findings were useful and why or why not. Emerging findings were shared in Fiji during and immediately following the fieldwork through a sharing session with the Local Reference Group, a seminar at the Fiji School of Medicine, and a presentation at the Pacific Islands Health Research Symposium. A copy of this completed thesis and a condensed report of the findings also will be sent to local partners.

This research was constrained by the practical resource and time constraints of a PhD which prevented the incorporation of more economic, environmental, and social dimensions to the analysis. An important future research opportunity would be to include these dimensions to more fully adopt an ecological public health perspective (Lang & Rayner, 2007) and better align with the burgeoning literature on sustainable diets (Burlingame & Dernini, 2010). This could be particularly helpful for Fiji and other small island states which face high levels of vulnerability to uncertainty. There is an increasing trend towards more multi-faceted analyses of value chains using the strategic business management framework, from which this future work could draw ideas. In particular, some management scholars recently have begun to consider the sustainability

of agri-food value chains and incorporated measures of environmental impact (Fearne et al., 2012; Soosay et al., 2012).

One possibility for future nutrition-oriented value chains research using the strategic business management framework is to study competing products and chains. Taking a nutrition perspective, the model could be used to compare chains for similar foods and could provide insights into how to increase the competitiveness of the more nutritious product and determine the supply-side incentives value chain actors need to produce healthier products. Examples might be a comparison of a chain for frozen fish compared to a chain for tinned fish, or between local citrus and imported citrus.

Another potential application could be the examination of *how* policy actions (in agriculture, health, or other sectors) contribute to the availability, affordability, and acceptability of foods through their effect on upstream value chain actors. This sort of information would help demystify the ‘black box’ linking agriculture and nutrition (Dangour et al., 2012; Turner et al., 2013) and could be used to identify the advantages and disadvantages to policy action, which could in turn to inform the broader global dialogue on policy options for addressing nutrition-related disease (Hawkes, Jewell, et al., 2013; Swinburn et al., 2013).

Another possibility could be to study trends over time. Through repeated rounds of fieldwork at regular intervals, the method could be used to examine how competitive pressures in value chains shift with other societal, cultural, and economic changes. In a developing country context, this could be an insightful approach to studying nutrition transition and provide complementary evidence to quantitative longitudinal data collected on food environments, diets, and health in major studies of nutrition transition (Popkin & Gordon-Larsen, 2004; Popkin, Horton, Kim, Mahal, & Shuigao, 2001).

9.6 Conclusions

This research adapted the strategic business management model of value chain analysis to nutrition. This framework supported the study of what urban Fijians value in FV and in-depth investigation of the structure and function of three exemplar FV chains serving Fiji's local urban market. The mixed-methods case study research involved focus group discussions with consumers, mapping workshops with stakeholders in the FV sector, and semi-structured interviews and observations with actors in the exemplar chains. While the research design had limitations, including the inability to attribute causality and reliance on a limited number of study participants, the approach was successful in identifying a number of bottlenecks and vulnerabilities in the exemplar chains that impair their ability to make ample quantities of high quality, low cost FV available to urban consumers. The findings suggest that consideration of consumer value and preferences will be essential to the success of any intervention aimed at improving production or consumption from a nutrition perspective.

Since this research project began, the importance of building evidence on opportunities to improve agri-food systems to support nutrition and health goals has been reinforced (Dangour et al., 2012; Hawkes et al., 2014, 2012; Nugent, 2011; Turner et al., 2013). This thesis showed that the adaptation of the strategic business management model of value chain analysis to nutrition has potential to address some knowledge gaps and provide critical information needed for the development of evidence-based policies and programmes to increase FV consumption, thus achieving its research aim and contributing new knowledge to science. By taking a systems perspective, the research uncovered a number of areas in Fijian FV value chains where actions taken influence product availability, affordability, and acceptability, thus suggesting possible leverage points for nutrition. The findings also support the thesis that a single intervention or single policy change by itself is unlikely to significantly change diets or reduce diet-related

disease (Hawkes, Jewell, et al., 2013; Hawkes et al., 2014; Lang & Rayner, 2007; Snowden & Swinburn, 2008).

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APPENDIX A: MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING
between
EMILY MORGAN (LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE)
and
NATIONAL FOOD AND NUTRITION CENTRE, MINISTRY OF HEALTH (FIJI)
and
RESEARCH DIVISION, DEPARTMENT OF AGRICULTURE (FIJI)

Emily Morgan of London School of Hygiene and Tropical Medicine, the National Food and Nutrition Centre (NFNC) within the Ministry of Health of Fiji, and the Research Division of the Department of Agriculture of Fiji (RD Ag) have developed this memorandum of understanding to facilitate the study of value chains for 2-4 fruit and vegetables in Fiji with a focus on local nutrition goals. This effort will contribute to local evidence on fruit and vegetable value chains in Fiji and the generation of a PhD thesis for Ms. Morgan.

RESEARCH ACTIVITIES

This project consists of a value chain analysis for nutrition, which includes both consumer research and value chain inquiry. Specific research activities will include analysis of data from the 2004 National Nutrition Survey, focus group discussions, individual interviews, observations of the value chain, and direct measurements of the flow of products through the chain.

DISTRIBUTION OF BENEFITS

This work will generate new data on the reasons why urban consumers in Fiji find various fruit and vegetable products acceptable or unacceptable and the activities within the value chains of these products that contribute to their availability, price, and local acceptability. The project will also provide policy relevant recommendations to the NFNC and RD Ag on how the value chains for fruit and vegetables may be levered to align health and agriculture objectives relating to increasing consumption of local fruits and vegetables.

Ms. Morgan will arrange the hire and training of at least two local part-time research assistants to support her work. These assistants will be involved in multiple aspects of the project and will gain hands-on experience in nutrition and agriculture research, thus building local capacity in qualitative methods for nutrition and agriculture research. In addition, training will be provided to NFNC staff on the use of the NVivo qualitative analysis software program on a pro bono basis.

This project will include novel data analysis on the 2004 National Nutrition Survey. This analysis will benefit the NFNC by exploring associations between food production, preparation, and purchasing and consumption of fruit and vegetables.

Ms. Morgan will be given the opportunity to learn about nutrition and agriculture in Fiji while completing original research to fulfil the requirements of a PhD degree.

CONTRIBUTION OF EACH ENTITY

Ms. Morgan: Ms. Morgan will serve as the primary investigator for this research project. She will lead all data collection, analysis and related writing and will prepare all study materials. Ms. Morgan will provide training and supervision for at least two part-time research assistants. As noted above, she will also provide training for NFNC staff on the use of the NVivo software programme. Upon completion of the fieldwork, a project report will be supplied to NFNC and Ms. Morgan will present the work to local stakeholders.

NFNC: The NFNC will act as Ms. Morgan's "host" institution for this research project. A senior representative of the NFNC will serve as the project's co-investigator and local counterpart. The NFNC will supply a letter of support for Ms. Morgan to undertake the research project and will support the submission of an application for ethical approval for this work.

As the formal host of this research, the NFNC will provide Ms. Morgan with adequate workspace for the duration of her time in Fiji. Ms. Morgan will have regular contact with the NFNC research team to support the sharing of data and information. The NFNC will advise on nutrition and the interpretation of the findings of this research. To facilitate the work, NFNC will provide Ms. Morgan with access to data from the 2004 National Nutrition Survey, with appropriate permissions from the Ministry of Health.

RD Ag: The RD Ag will supply a letter of support for Ms. Morgan to undertake the research project. The Division will also facilitate contact between Ms. Morgan and participants in the selected fruit and vegetable value chains. During the data collection period, Ms. Morgan will meet intermittently with the RD Ag to share information and discuss progress. Upon completion of the fieldwork, Ms. Morgan will present the findings to RD Ag.

TIMELINE

Data collection will commence in early- to mid-2012, pending UK and Fijian ethical approval and immigration clearance and will continue for 6-12 months.

FUNDING AND FINANCES

Full funding to undertake this work has been secured from the Leverhulme Centre for Integrative Research in Agriculture and Health. This funding includes a stipend for Ms. Morgan and covers research expenses, including transport costs, operational costs, and equipment costs. No funding will be requested from the NFNC or RD Ag. Project financing, including research assistant salaries, will not flow through either NFNC or RD Ag. Should any financial arrangements arise from the work they shall be the subject of a separate written agreement.

SHARING OF OUTPUTS


Ms. Morgan will give formal presentations of the final results to the NFNC and RD Ag before the completion of her research degree and a study report will be supplied. A copy of the completed thesis will be given to NFNC and to RD Ag. Additional copies will be supplied to the Department of Immigration and the Ministry of Education, in accordance with national law. Also, a copy of the de-identified data will be given to NFNC. Intellectual Property including Copyright of this thesis will belong to the London School of Hygiene and Tropical Medicine.

DURATION

This MOU shall remain in place for the duration of Ms. Morgan's work in Fiji for the purposes of her PhD.

MEMORANDUM OF UNDERSTANDING
between
EMILY MORGAN (LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE)
and
NATIONAL FOOD AND NUTRITION CENTRE, MINISTRY OF HEALTH (FIJI)
and
RESEARCH DIVISION, DEPARTMENT OF AGRICULTURE (FIJI)

For London School of Hygiene and Tropical Medicine:



Penelope Ireland, Research Contracts Manager

Date 16 May 2012


For National Food and Nutrition Centre:



Ateca Kama, Acting Manager

Date 18 May 2012

For Research Division of the Department of Agriculture:



Miliakere Nawaikula, Director Research

21 May 2012

Date

This agreement may be amended or void by means of common written consent on the part of the signatories.

APPENDIX B: TERMS OF REFERENCE FOR LOCAL REFERENCE GROUP

Fruit and Vegetable Value Chains Study

Local Reference Group

Terms of Reference

Purpose

The purpose of the Local Reference Group is to provide practical advice that will support the Study's data collection and interpretation activities and enhance the quality, relevance, and local utility of the findings.

Membership

Members will be local project partners representing the National Food and Nutrition Centre, the Department of Agriculture, and the Pacific Research Centre for the Prevention of Obesity and Non-communicable Diseases. Other individuals may be invited by the convenor (Emily Morgan) to assist with particular expertise in a subject matter under discussion.

Benefits of Membership

Coinciding with each meeting, Ms. Morgan will prepare a brief (1-2 page) project update for Members. At the end of data collection, Members will also receive a report of initial findings. Refreshments or lunch will be provided at each Reference Group meeting. Membership is unpaid.

Roles and Functions

Members will provide:

- Advice on emergent issues affecting recruitment and data collection
- Feedback, ideas, and advice on the interpretation of preliminary findings

Meetings

Meetings will be held every 8-12 weeks during data collection, unless otherwise agreed. Meetings will last approximately 75-90 minutes.

Accountability

The role and functions of the Reference Group are advisory in nature. It is not a decision-making forum and responsibility for planning and executing the research lies with Emily Morgan, in line with approvals granted by the Ministry of Education, Department of Immigration, National Health Research Council, Fiji National Research Ethics Review Committee, and the Ethics Committee at the London School of Hygiene and Tropical Medicine.

APPENDIX C: ENDORSEMENT BY LOCAL HOSTS



A Healthy Fiji through Good Nutrition
NATIONAL FOOD AND NUTRITION CENTRE



Ref: NFNC 4/19

Date: 24th February, 2012

The Director of Immigration
Department of Immigration
Ministry of Defence, National Security and Immigration
PO Box 2224, Govt Buildings
Suva
Fiji

Dear Sir

Re: SUPPORT LETTER FOR MS EMILY MORGAN'S RESEARCH

This is to confirm that Ms Emily Morgan, candidate for PhD in Public Health and Policy at the London School of Hygiene and Tropical Medicine, will be based at the National Food and Nutrition Centre (NFNC), while carrying out her research work in Fiji.

Ms Morgan will be carrying out her research on "The applicability of value chain approaches to address low fruit and vegetable consumption in Fiji".

In supporting Ms Morgan's research, the NFNC anticipates new information as to the reason of low consumption of fruits and vegetables in the country which is linked to non communicable diseases (NCDs). The findings from this research will add value to information already available that could contribute to the increase in consumption of fruits and vegetables in the population.

The NFNC will provide technical support in terms of nutrition advice into Ms Morgan's research.

We would be grateful for any assistance that you could render Ms Morgan regarding her application for research approval.

Thank you



Penina Vatucaawaqa (Ms)

For Manager

Postal Address: P.O. Box 2450, Government Buildings, Suva, Fiji Office Location: 1 Clarke Street, Off Denison Road, Suva.
Telephone: 331 3055 Fax: 330 3921 E-mail: nfnc@connect.com.fj Website: www.nutrition.gov.fj

Improving the nutritional status of the population in Fiji



MINISTRY OF PRIMARY INDUSTRIES
Department of Agriculture
Private Mail Bag
Raiwaqa
FIJI



Phone: (679) 3384233
Fax No. (679) 3385234
Website: www.agriculture.org.fj

TO WHOM IT MAY CONCERN

re: Support for Ms. Emily Morgan's Research

This letter is to confirm that the Research Division of the Department of Agriculture, in collaboration with the National Food and Nutrition Centre (NFNC), supports Ms. Emily Morgan's research project, "The applicability of value chain approaches to address low fruit and vegetable consumption in Fiji."

The Department of Agriculture will support Ms. Morgan in identifying and recruiting potential participants for the value chain mapping and interview components of her project. We will also provide agricultural advice throughout the duration of her project.

Ms. Morgan's research will generate new information on why present consumption of local fruit and vegetables is low and what opportunities exist in the agricultural value chain for increasing consumption. These anticipated findings will add to what is presently known about the fruit and vegetable supply in Fiji and will support the Department of Agriculture in its efforts to promote the consumption of local products.

Thank you,



Miliakere Nawaikula
Director (Research)

APPENDIX D: ENDORSEMENT BY MINISTRY OF EDUCATION



MINISTRY OF EDUCATION, NATIONAL HERITAGE CULTURE & ARTS, YOUTH & SPORTS

Quality Education for Change, Peace and Progress



Resident Address: Marela House, 19 Thurston Street, Suva, Fiji.

Ph: (679) 3314477

Postal Address: Private Mail Bag, Government Buildings, Suva, Fiji.

Fax: (679) 3303511

Our Reference:

Your Reference:

Date: 06/03/2012

Ms Emily Morgan,
LIDC, 36,
Gordon Square,
London WC1H 0PD,
United Kingdom.

Re: **Approval for Research Studies.**

I am pleased to inform you that your application to conduct a research in Fiji on the topic "**The Applicability of Value Chain Approaches to Address Low Fruit and Vegetable Consumption in Fiji,**" has been approved.

This approval is for the period April 2012 – December 2013.

As a condition for all research approvals, a copy of the final research final should be submitted to this office as soon as it is ready. This will be properly archived as a reference point for the Ministry of Education.

Moreover, it is important to note that the Ministry of Education reserves the sole right to publish the final report or an edited summary of it.

Finally, the Ministry extends its best wishes in your research and studies.

With thanks.

Vilikesa Naivalucava [Mr]

for **Permanent Secretary for Education, National Heritage, Culture and Arts.**

ALL COMMUNICATIONS TO BE ADDRESSED TO THE PERMANENT SECRETARY FOR EDUCATION,
NATIONAL HERITAGE, CULTURE & ARTS

APPENDIX E: PARTICIPANT INFORMATION SHEETS AND CONSENT FORMS

Fruit and Vegetable Value Chains Study Consumer Focus Group Participant Information Sheet

The Fruit and Vegetable Value Chains Study is a research project between the London School of Hygiene and Tropical Medicine and the National Food and Nutrition Centre in Fiji to evaluate Fiji's fruit and vegetable supply and identify opportunities for improving it to better meet consumer demand.

RESEARCH OBJECTIVE

Low fruit and vegetable consumption has been identified in Fiji and is a risk factor for several diseases, including heart disease, some cancers, and type II diabetes. This research aims to identify why people in the Suva-Nausori area choose fruit and vegetables.

PARTICIPATION

This study component includes research with consumers of fruit and vegetables, aged 21 and older. You can participate by attending one focus group, which will include between 6 and 8 people of a similar background to you. The group will last a maximum of an hour and a half and will be audio-recorded. During this session, we will ask participants to discuss between themselves what choice of fruits and vegetables, which fruits and vegetables are preferred and used most, and where these products are usually obtained.

RIGHTS

Taking part in this study is voluntary. You may choose not to participate or you may withdraw from the project at any time without giving any reason.

BENEFITS

Your participation will help us understand why people in Suva choose or do not choose to eat certain fruits and vegetables. This information can be used to better understand what can be done with the agricultural supply system to increase fruit and vegetable consumption. We will not be giving any compensation for participating in this study but will provide refreshments during the focus group. Participants will be asked to only share information they feel comfortable talking about in front of others.

CONFIDENTIALITY

We will make sure all materials with your name on them are kept in secured places at the National Food and Nutrition Centre (during the study) and London School of Hygiene and Tropical Medicine (following completion of the study). Your name will not be included on any data collection sheets. Only project personnel will have access to this information. We will never share your name with others.

FOR MORE INFORMATION

If you have any questions or concerns about this study you may contact the investigators at any time.

Emily Morgan

London School of Hygiene & Tropical Medicine

Email: Emily.morgan@lshtm.ac.uk

Phone: 938 9735

Ateca Kama

National Food and Nutrition Centre

Email: ateca.kama@yahoo.com

Phone: 331 3055

ETHICAL APPROVAL: This study has been approved by the National Health Research Committee (Fiji) and the London School of Hygiene and Tropical Medicine (UK).

Fruit and Vegetable Value Chains Study

Consumer Focus Group

Consent Form

Please go over the statements carefully and circle one answer for each of them. Ask your interviewer any questions necessary for you to understand these statements.

1.	I have read the information sheet concerning this study [or have understood the verbal explanation] and I understand what will be required of me and what will happen to me if I take part in it.	YES / NO
2.	My questions concerning this study have been answered by my interviewer.	YES / NO
3.	I understand that at any time I may withdraw from this study without giving reason and without it affecting my normal care and management.	YES / NO
4.	I confirm that I am at least 21 years old.	YES / NO
5.	I agree to take part in this study.	YES / NO
6.	I agree to quotations from my participation in the study to be included anonymously in reports about the study.	YES / NO

I hereby provide INFORMED CONSENT to take part in the Fruit and Vegetable Value Chains Study.

Name: _____

Signature/Thumbprint: _____

Date: _____

Interviewer: _____

Fruit and Vegetable Value Chains Study
Value Chain Mapping Research
Participant Information Sheet

The Fruit and Vegetable Value Chains Study is a research project to evaluate Fiji's fruit and vegetable supply and identify opportunities for improving it to better meet consumer demand.

RESEARCH OBJECTIVE

Low fruit and vegetable consumption has been identified in Fiji and is a risk factor for several diseases, including heart disease, some cancers, and type II diabetes. This research aims to map the pathways through which fruit and vegetables travel in Fiji to reach consumers in the Suva-Nausori area.

PARTICIPATION

This study component includes research with people aged 21 or older who work in fruit and vegetable supply systems, study them, or monitor them. You can participate by participating in a workshop that will include 3-5 other people and will last a maximum of two hours. This workshop will be audio-recorded. During the workshop, we will ask participants to work together to explain the pathways that fruit and vegetables flow through in Fiji to meet consumers in the Suva-Nausori area and then draw basic maps of these pathways.

RIGHTS

Taking part in this study is voluntary. You may choose not to participate or you may withdraw from the project at any time without giving any reason.

BENEFITS

Your participation will help us understand the pathways through which fruit and vegetables flow in Fiji before reaching consumers. This information can be used to identify possible agricultural interventions to increase fruit and vegetable consumption. We will not be giving any compensation for participating in this study but will provide refreshments during the workshop and will reimburse you for your travel if you use public transportation (for example, the bus) and save your receipt.

CONFIDENTIALITY

We will make sure all materials with your name on them are kept in secured places at the National Food and Nutrition Centre (during the study) and London School of Hygiene and Tropical Medicine (following completion of the study). Only project personnel will have access to this information. We will never share your name with others. In reports of this study, we may anonymously identify you by your role in the supply system.

FOR MORE INFORMATION

If you have any questions or concerns about this study you may contact the investigators at any time.

Emily Morgan
London School of Hygiene & Tropical Medicine
Email: Emily.morgan@lshtm.ac.uk
Phone: 938 9735

Ateca Kama
National Food and Nutrition Centre
Email: ateca.kama@yahoo.com
Phone: 331 3055

ETHICAL APPROVAL: This study has been approved by the National Health Research Committee (Fiji) and the London School of Hygiene and Tropical Medicine (UK).

Fruit and Vegetable Value Chains Study
Value Chain Mapping Research
Consent Form

Please go over the statements carefully and circle one answer for each of them. Ask your interviewer any questions necessary for you to understand these statements.

1.	I have read the information sheet concerning this study [or have understood the verbal explanation] and I understand what will be required of me and what will happen to me if I take part in it.	YES / NO
2.	My questions concerning this study have been answered by my interviewer.	YES / NO
3.	I understand that at any time I may withdraw from this study without giving reason and without it affecting my normal care and management.	YES / NO
4.	I confirm that I am at least 21 years old.	YES / NO
5.	I agree to take part in this study.	YES / NO
6.	I agree to quotations from my participation in the study to be included anonymously in reports about the study.	YES / NO

I hereby provide INFORMED CONSENT to take part in the Fruit and Vegetable Value Chains Study.

Name: _____

Signature/Thumbprint: _____

Date: _____

Interviewer: _____

Fruit and Vegetable Value Chains Study
Value Chain Interview Research
Participant Information Sheet

The **Fruit and Vegetable Value Chains Study** is a research project to evaluate Fiji's fruit and vegetable supply and identify opportunities for improving it to better meet consumer demand.

RESEARCH OBJECTIVE

This research aims to identify opportunities for improving the supply of fruit and vegetables to consumers in the Suva-Nausori area. Low fruit and vegetable consumption has been identified in Fiji and is a risk factor for several diseases, including heart disease, some cancers, and type II diabetes.

PARTICIPATION

This study component includes research with people that work in the fruit and vegetable supply system. If you are 21 or older, you can participate by taking part in an interview, where you will be asked about your job and how you handle and manage your products and operations. This interview will last a maximum of one hour and will be audio-recorded, unless you prefer not to be recorded. If you would like to participate, but do not want to be recorded, we can take notes on the discussion instead.

RIGHTS

Taking part in this study is voluntary. You may choose not to participate or you may withdraw from the project at any time without giving any reason.

BENEFITS

Your participation will help us understand the ways in which fruit and vegetables are handled and managed in Fiji before reaching consumers. This information can be used to better understand what possible agricultural interventions might lead to increased fruit and vegetable consumption. We will not be giving any compensation for participating in this study.

CONFIDENTIALITY

We will make sure all materials with your name on them are kept in secured places at the National Food and Nutrition Centre (during the study) and London School of Hygiene and Tropical Medicine (following completion of the study). Only project personnel will have access to this information. We will never share your name with others. In reports of this study, we may anonymously identify you by your role in the supply system.

FOR MORE INFORMATION

If you have any questions or concerns about this study you may contact the investigators at any time.

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Email: ateca.kama@yahoo.com

Phone: 331 3055

ETHICAL APPROVAL: This study has been approved by the National Health Research Committee (Fiji) and the London School of Hygiene and Tropical Medicine (UK).

Fruit and Vegetable Value Chains Study
Value Chain Interview Research
Consent Form

Please go over the statements carefully and circle one answer for each of them. Ask your interviewer any questions necessary for you to understand these statements.

1.	I have read the information sheet concerning this study [or have understood the verbal explanation] and I understand what will be required of me and what will happen to me if I take part in it.	YES / NO
2.	My questions concerning this study have been answered by my interviewer.	YES / NO
3.	I understand that at any time I may withdraw from this study without giving reason and without it affecting my normal care and management.	YES / NO
4.	I confirm that I am at least 21 years old.	YES / NO
5.	I agree to take part in this study.	YES / NO
6.	I agree to quotations from my participation in the study to be included anonymously in reports about the study.	YES / NO

I hereby provide INFORMED CONSENT to take part in the Fruit and Vegetable Value Chains Study.

Name: _____

Signature/Thumbprint: _____

Date: _____

Interviewer: _____

Fruit and Vegetable Value Chains Study
Value Chain Observational Case Study Research
Participant Information Sheet

The **Fruit and Vegetable Value Chains Study** is a research project to evaluate Fiji's fruit and vegetable supply and identify opportunities for improving it to better meet consumer demand.

RESEARCH OBJECTIVE

This research aims to identify opportunities for improving the supply of fruit and vegetables to consumers in the Suva-Nausori area. Low fruit and vegetable consumption has been identified in Fiji and is a risk factor for several diseases, including heart disease, some cancers, and type II diabetes.

PARTICIPATION

This study component includes research with people that work in the fruit and vegetable supply system. If you are 21 or older, you can participate by taking permitting a member of the research team to come to your operation and observe from one to three days. We are interested to see how fruit and vegetables travel from farm to consumers. In addition to observing and taking notes and some timed measurements, we may also ask questions about product handling and management.

RIGHTS

Taking part in this study is voluntary. You may choose not to participate or you may withdraw from the project at any time without giving any reason.

BENEFITS

Your participation will help us understand the ways in which fruit and vegetables are handled and managed in Fiji before reaching consumers. This information can be used to better understand what possible agricultural interventions might lead to increased fruit and vegetable consumption. We will not be giving any compensation for participating in this study.

CONFIDENTIALITY

We will make sure all materials with your name on them are kept in secured places at the National Food and Nutrition Centre (during the study) and London School of Hygiene and Tropical Medicine (following completion of the study). Only project personnel will have access to this information. We will never share your name with others. In reports of this study, we may anonymously identify you by your role in the supply system.

FOR MORE INFORMATION

If you have any questions or concerns about this study you may contact the investigators at any time.

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London School of Hygiene & Tropical
Medicine
Email: Emily.morgan@lshtm.ac.uk
Phone: 938 9735

Ateca Kama
National Food and Nutrition Centre
Email: ateca.kama@yahoo.com
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ETHICAL APPROVAL: This study has been approved by the National Health Research Committee (Fiji) and the London School of Hygiene and Tropical Medicine (UK).

Fruit and Vegetable Value Chains Study
Value Chain Observational Case Study Research
Consent Form

Please go over the statements carefully and circle one answer for each of them. Ask your interviewer any questions necessary for you to understand these statements.

1.	I have read the information sheet concerning this study [or have understood the verbal explanation] and I understand what will be required of me and what will happen to me if I take part in it.	YES / NO
2.	My questions concerning this study have been answered by my interviewer.	YES / NO
3.	I understand that at any time I may withdraw from this study without giving reason and without it affecting my normal care and management.	YES / NO
4.	I confirm that I am at least 21 years old.	YES / NO
5.	I agree to take part in this study.	YES / NO
6.	I agree to quotations from my participation in the study to be included anonymously in reports about the study.	YES / NO

I hereby provide INFORMED CONSENT to take part in the Fruit and Vegetable Value Chains Study.

Name: _____

Signature/Thumbprint: _____

Date: _____

Interviewer: _____

APPENDIX F: EXEMPLAR PRODUCT DESCRIPTIONS

Amaranthus

Amaranthus (*Amaranthus viridis*) – known by iTaukeis as ‘tubua’ or ‘moca’ and Fijians of Indian descent as ‘chauraiya’ or ‘bhaji’ – is a popular leafy green vegetable in Fiji (Figure 16).

Although not indigenous to the Pacific region, the herbaceous spinach has naturalized and now thrives year-round. As a self-seeding plant, amaranthus grows widely both cultivated and as a weed (Bailey, 1992; Smith, 1992). It requires considerable water for growth and is susceptible to leaf-eating insects, but is not known to be impacted by any major disease (Department of Agriculture, 2010a; Goebel, Taylor, & Lyons, 2012; Thaman, 1990). Amaranthus is of dietary importance both as a subsistence and commercial crop (Thaman, 1990). In 2009, an estimated 23,002 kg was grown in Fiji, of which over 70% was produced for sale (Department of Agriculture, 2011).



Figure 16. Fijian amaranthus
Source: Author

Amaranthus is high in dietary fibre and a rich source of protein, vitamins A, B, and C, and most minerals, particularly zinc, calcium, magnesium, and iron (Dignan, Burlingame, Kumar, &

Aalbersberg, 2004; Goebel et al., 2012; Thaman, 1990). The leaves are cooked before eating and consumed alone or added to dishes, such as soups and curries (Goebel et al., 2012). Amaranthus is consumed by all local ethnic groups, but is “the most important green vegetable in the Indian diet” (Thaman, 1990, p. 54).

Papaya

Papaya (*Carica papaya*) – often referred to locally as ‘pawpaw’ or ‘papita’ – is produced and consumed year-round in Fiji (Figure 17). It was introduced post-European contact, but is now a major subsistence and commercial crop (Thaman, 1990). In 2009, 465 farms in Fiji produced papaya (Department of Agriculture, 2011). Commercial production is small-holder led, with 70% of papaya growers clustered in the Western Division, especially the Nadroga Province (encompassing the Sigatoka Valley) (Department of Agriculture, 2011). Papaya is grown for sale in local and tourist markets and for airfreight export to Australia, New Zealand, Hong Kong, and Japan.



Figure 17. Fijian *Solo Sunrise* papayas
Source: Author

In 1996, a high temperature forced air (HTFA) facility was established in Fiji to provide quarantine treatment for papaya exports. Since, the industry has grown and today papaya is Fiji's most important fruit export (McGregor, Gonemaituba, & Stice, 2009), with an estimated 150 growers producing the crop with the goal of exporting (Kyle Stice, personal communication, March 14, 2013). Whilst wild papayas grow around the island, the main variety produced for export is *Solo Sunrise*, which has been branded as 'Fiji Red' in overseas marketing. The variety is known for its high sweetness, rich flavour, red coloured flesh, and large size (*Information Sheet – "Fiji Red"*, 2009). Papaya is normally open pollinated; however, maintaining seed purity of the 'Solo Sunrise' line and avoiding cross pollination is a high priority for the papaya export industry (*Information Sheet – High quality seedlings for success*, 2009). Only plants grown from true type seed material produce fruit that are suitable for export (Kyle Stice, personal communication, March 14, 2013).

Fiji is considered to have favourable growing conditions for papaya, particularly in regards to pests and disease. Notably, Fiji is free of papaya ring spot virus, which decimated the Hawaiian papaya industry (McGregor et al., 2009). For optimal production, irrigation and fertilization of the fruit are emphasized (McGregor et al., 2009).

Papaya are a good source of calcium, potassium, vitamins A, E, and C, and antioxidants (Dignan et al., 2004; Lako et al., 2007). The fruit is consumed raw when ripe or cooked in dishes when unripe.

Tomato

Tomato (*Lycopersicon esculentum*) is a seasonal crop in Fiji, produced mainly in the cool, dry months of May to October (Department of Agriculture, 2010b; Thaman, 1990) (Figure 18).

Local production is subject to bacterial and fungal infection, as well as insect damage, particularly during the rainy season. As with the other exemplar products, tomato was introduced

post-European contact. It is grown primarily as a commercial crop (Thaman, 1990). In recent years, small quantities of fresh tomatoes have been exported, but the overwhelming majority of local production goes to the domestic market (Vatucawaqa, 2011, 2012), including local markets and the tourist industry. The 2009 Agriculture Census indicated 3,045 farms engaged in tomato production, half of which were in the Central Division, particularly the Nadroga and Ba Provinces (Department of Agriculture, 2011).



Figure 18. Fijian tomatoes
Source: Author

Tomatoes are an excellent source of dietary fibre, vitamins A, C, E, and K, and most minerals, especially potassium, calcium, and manganese (Dignan et al., 2004). They are the most commonly consumed red/orange vegetable by both ethnic groups in Fiji (Schultz, Vatucawaqa, & Tuivaga, 2007).

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APPENDIX G: TOPIC GUIDE FOR FOCUS GROUP DISCUSSIONS

Topic Guide for Focus Group Discussions

Questions	Probes
Source of fruit and vegetables	
<ul style="list-style-type: none"> Where do you and/or members of your immediate family normally obtain fruits and vegetables? 	<ul style="list-style-type: none"> Home production Purchasing – where? Gifts or in-kind payments Restaurants or take-away food <p>Prompt- why, pros/cons</p>
Reasons for acceptability	
<ul style="list-style-type: none"> Why do you normally eat fruits and/or vegetables? Why do/don't you eat certain fruits or vegetables? 	<ul style="list-style-type: none"> Appealing/unappealing characteristics of fruit and vegetable food group
<ul style="list-style-type: none"> What motivates you to choose certain fruits and/or vegetables? 	<ul style="list-style-type: none"> Price Availability Taste Appearance Smell Convenience Health Process Social/cultural <p>Probe for each exemplar product</p>
<ul style="list-style-type: none"> What are the most important decision-making factors for buying and eating fruit and vegetables? 	<ul style="list-style-type: none"> Price Availability Taste Appearance Smell Convenience Health Process Social/cultural <p>Probe for each exemplar product</p>
<ul style="list-style-type: none"> How do you prefer to eat fruit and vegetables? How do members of your family prefer to eat fruit and vegetables? 	<ul style="list-style-type: none"> Fresh Cooked – how? Preserved another way – how?

APPENDIX H: TOPIC GUIDE FOR KEY INFORMANT INTERVIEWS

Topic Guide for Semi-structured Interviews

Question	Probes
Movement of fruit and vegetables along the value chain (i.e. material flow)	
<ul style="list-style-type: none"> Describe what you do in your business. What are all of the different things that you do to grow/prepare your product? (Note: Ask for specific details. The aim is to list everything that happens in their operation.) 	<ul style="list-style-type: none"> What happens first, what next, etc? Where does the product go once you have finished?
<ul style="list-style-type: none"> What is the typical sized 'batch' of the product you produce/sell/transport? What affects this amount? 	<ul style="list-style-type: none"> Seasonal By demand Dependent on another limiting factor (e.g. transport)
<ul style="list-style-type: none"> How long do you usually spend on each activity with each 'batch' of the product? 	<ul style="list-style-type: none"> Use list created from first question and gather as many 'timed' details as possible.
<ul style="list-style-type: none"> Where do you store the product? 	<ul style="list-style-type: none"> Shade Other protection Sun Refrigeration
<ul style="list-style-type: none"> How do you transport the product? Where do you transport the product to, and why? 	<ul style="list-style-type: none"> Truck Car Bili bili Air Combination or other
<ul style="list-style-type: none"> How much of your product falls into each of these damage classes? How do your markets and opportunities change depending on a product or batch's level of damage? 	<ul style="list-style-type: none"> Use scale of product damage to prompt.
Partnerships in the value chain (i.e. relationships)	
<ul style="list-style-type: none"> To whom do you usually sell your products? To whom do you usually give your product to? 	<ul style="list-style-type: none"> Why? For how long? Does it vary?
<ul style="list-style-type: none"> How do you make decisions about where to sell your product? 	<ul style="list-style-type: none"> Demand Quality Price Other
Information flow	
<ul style="list-style-type: none"> Where do you receive information about what consumers in the market want? 	<ul style="list-style-type: none"> Buyer Market observation Government extension workers Taiwan Technical Mission Other